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Attorneys for Plaintiff
ACACIA MEDIA TECHNOLOGIES CORPORATION

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

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| In re<br><br>ACACIA MEDIA TECHNOLOGIES CORPORATION, | Case No.05 CV 01114 JW<br><br>**DECLARATION OF S. MERRILL WEISS IN SUPPORT OF PLAINTIFF ACACIA MEDIA TECHNOLOGIES CORPORATION'S OPPOSITION TO:**<br><br>**1. ROUND 3 DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY UNDER 35 U.S.C. § 112 OF THE '992, '863, AND '702 PATENTS; AND**<br><br>**2. SATELLITE DEFENDANTS' MOTION FOR SUMMARY JUDGMENT OF INVALIDITY OF THE '992, '863, AND '720 PATENTS**<br><br>Date: TBD<br>Time: TBD<br>Ctrm: 8, 4th Floor<br>Judge: Hon. James Ware |

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# I. INTRODUCTION

1. I, S. Merrill Weiss, am a citizen of the United States and reside in Edison, New Jersey.

2. I have been retained by counsel for plaintiffs, Acacia Media Technologies Corporation, as a testifying expert to study and provide consultation, testimony, and opinions regarding the patent infringement litigation with respect to U.S. Patent Number 5,132,992 (the '992 patent) and its continuations, as described in this report. Specifically, I have been retained to testify on the topics of television as it was practiced in the United States in January, 1991, of television standards, their development, and their interpretation, and of the development of electronics and computer technology leading up to and around the date of original submission of the patent. My testimony may include: the interpretation and understanding of the patent at issue by a person of ordinary skill in the art of the patent in January, 1991; the common knowledge available to one of ordinary skill in the art of the patent in January, 1991; my interpretation and understanding of industry standards; and my opinions about issues affecting the validity of the patent at issue and its possible infringement by the products or services of the defendants. Most immediately, this report deals with questions about the enablement and written description of certain elements and functions described in the patent.

# II. CREDENTIALS

3. I am a consultant in electronic media technology, technology management, and management, serving clients in the United States, Canada, Japan, Europe, and the Middle East. These clients have included broadcast television networks, broadcast television stations, cable and satellite programming networks, cable, wireless cable, and satellite television system operators, research laboratories, Hollywood studios, broadcast and television equipment manufacturing companies, common carriers of television and other broadcast signals, investment bankers, as well as industry associations representing these types of entities. During the course of my consulting work, I am in routine contact with employees of the entities discussed above, including those employees having programming and engineering responsibilities.

4. I have over forty-one years experience in broadcasting and related fields, with over

thirty-one years in management and consulting. My experience includes over forty years designing, building, and managing new technical facilities for various electronic media employers and clients. From 1985-1991, I was employed by the National Broadcasting Company (NBC) as Managing Director of Systems Engineering and as Managing Director of Advanced Television Systems.

5. For over thirty-one years, I have worked on the development of new television technologies and the writing of standards for them, including analog video, digital video, component video, digital control, digital video compression, and all the associated data and metadata functionality. I conducted the experiments that led to the very first digital television standard (CCIR Recommendation 601) in 1981. That standard is the standard upon which most subsequent digital television standards draw, including the widely used MPEG-2 and MPEG-4 digital video compression standards. Since that time, I have been involved in the development of most of the digital television standards and many other related standards. I am currently involved in the development of enhanced and interactive television and other technologies that depend upon the convergence of television, computing, and data communications.

6. I served as the chairman of one or another of the technology committees of the Society of Motion Picture and Television Engineers (SMPTE) continuously for over twenty-six years. I served four years as the SMPTE Engineering Director for Television, chairing its TV Steering Committee. In that role, I was responsible for managing the worldwide development of standards for television, along with a wide range of other technologies. I served as co-chairman, with a European counterpart, of the joint SMPTE/European Broadcasting Union (EBU) Task Force for Harmonized Standards for the Exchange of Program Material as Bit Streams. I was the initiator, author, and final editor of the only adopted technical standard written for the NTSC color television system (SMPTE 170M). I was nominated for a technical Emmy Award for my work on serial digital interfaces for television systems. Subsequent to my service as SMPTE Engineering Director for Television, I chaired the SMPTE Committee on Systems Technology (S22), having responsibility, among other things, for standards for time code, in particular SMPTE 12M. I served as chairman of the SMPTE Committee on Registration and Identification Technology (R30), having responsibility for development of standards for identification of program content and for SMPTE

registration activities. I participated in the work of the relevant body of the International Standards Organization (ISO) as a liaison from SMPTE on the subject of content registration and identification.

7. I significantly contributed to the work of the FCC Advisory Committee on Advanced Television Service (ACATS). I participated extensively on implementation matters and in both the technical and economic analyses of the various system proposals, including the digital systems that were the progenitors of MPEG-2. I currently participate in a wide range of the Advanced Television Systems Committee's (ATSC) efforts to document and guide the implementation of Digital Television (DTV). Within ATSC, I have been responsible for development of standards on Directed Channel Change (DCC) and Distributed Transmission – a form of Single Frequency Network (SFN) – and a variety of other technologies.

8. I am a member of the Society of Cable Telecommunications Engineers (SCTE) and have participated in the standards development work of its Digital Video Subcommittee (DVS). The SCTE DVS develops standards for digital television signals on cable networks, cable set top boxes, and cable-ready television receivers. In that body, I served both to represent the interests of my clients and as a liaison to the SMPTE and the ATSC.

9. I have presented or published well over one hundred technical papers on diverse television and related technologies. I have also published books regarding advanced television technology and am the editor of a series of books for electronic media professionals. I have been recognized by the Society of Motion Picture and Television Engineers by elevation to the rank of Fellow (in 1987), and was the 1995 recipient of its David Sarnoff Gold Medal Award. In 2005, I received the SMPTE Progress Medal Award – its highest honor, and, in 2006, I was the recipient of the Television Engineering Achievement Award of the National Association of Broadcasters. I hold two issued U.S. and international patents, with an application for a third U.S. patent pending. Additionally, the Society of Broadcast Engineers (SBE) recognizes me as a Certified Professional Broadcast Engineer. I am a member of the Institute of Electrical and Electronics Engineers (IEEE).

10. I have a Bachelor of Business Administration degree from the Wharton School of the University of Pennsylvania. I am self-taught in electronics technology, but, during one period in the

late 1980's, I had 36 degreed engineers working for me during my employment by NBC, throughout which time I served as the ultimate problem solver for technical problems that the engineers in my employ were unable to resolve by themselves.

11. For a significant part of my career, I was employed to design systems for broadcast facilities, sometimes including the design of special-purpose hardware and software to provide functions not available except through custom design and construction. When at NBC, I served as the ultimate technical authority with respect to decisions on choices of technology. While I worked for Westinghouse Broadcasting Company prior to NBC, I participated in the development and installation of computerized automation systems at KYW Television in Philadelphia and KPIX in San Francisco. I designed and built new studio facilities for KPIX from the ground up and was responsible for the selection and installation there of the first central lending library still store system worldwide, along with other technical innovations.

12. I first programmed a computer nearly fifty years ago and have done programming on various levels over the years since. My programming experience has included machine code, assembly language, and several higher level languages. While at KPIX, in 1978-79, I developed the first machine control system for the television industry based on networked microprocessor controllers, and the fundamental characteristics of my design ultimately were adopted as an industry standard by the SMPTE. I also developed computer interface equipment that tied together several computer networks and drove the operation of automated videotape playback machinery. Those computer systems operated error-free for over a dozen years before being replaced with more modern equipment.

13. A complete copy of my current *curriculum vitae* (labeled as a resume), which summarizes my qualifications and professional experience, is attached as Exhibit A hereto. My *curriculum vitae* include a list of my publications.

## III. COMPENSATION

14. I am being compensated for my work in this case at my customary rate of $450 per hour, plus expenses. In the event I am called to testify my compensation rate is $500 per hour. My compensation is not based on the outcome of the litigation.

## IV. PRIOR TESTIMONY

15. Within the last four (4) years, I have not testified as an expert witness at trial. I have testified by deposition and at a Markman hearing only in the current case.

## V. OVERVIEW OF PATENT AT ISSUE

16. The patent at issue in this case is U.S. Patent Number 5,132,992, Audio and Video Transmission and Receiving System, and its continuations, to Paul Yurt and H. Lee Brown. It describes a system that, in one aspect, supports a service called "Video-On-Demand" (VOD) and a comparable service for audio programming, in which users are able to request programs they wish to watch or to which they wish to listen. The system uses video and audio compression to make the data representing the programs stored on the system occupy less storage space on the system and to permit faster transfer of the data from the system to the receiving devices used by consumers to view and/or listen to the content.

17. The system of the patent is built on a combination of the technologies of television, computing, and data communications. It employs the methods of television system automation, using computer databases, process control applications, and operations timed to the inherent cadence of video and audio signals as well as to real world time ("wall clock" time). The system described can store at the point of consumption the data transferred from a central repository for the content. That storage at the point of consumption (buffering) allows viewing or listening at times other than that at which the content is delivered and permits transfers both faster and slower than real time (non-real time) to take advantage of the capabilities of a variety of delivery media available for the purpose. The patent teaches how to create VOD and other sorts of delivery applications across a variety of delivery media including commonly available data communications channels, cable television networks and systems, satellite services, terrestrial broadcast channels, and, indirectly, the Internet. The use of these technologies leads directly to the characteristics that would be possessed by one of ordinary skill in the art as described in the next section.

## VI. ONE OF ORDINARY SKILL IN THE ART OF THE PATENT

18. I have been asked to give my opinion as to the educational and vocational qualifications of one of ordinary skill in the subject matter taught by the patent at the time of the

invention, which is January, 1991.

19. In January, 1991, a hypothetical person of ordinary skill in the art to whom this patent is addressed would have a range of knowledge roughly equivalent to that of a person holding a degree of Bachelor of Science in Electrical Engineering, Computer Science, or Computer Engineering with experience in systems design in the television and related electronic media industries. An actual engineering degree or a higher degree than a Bachelor's degree would not be necessary since none of the patent subject matter is at a high theoretical level; rather, it reflects engineering systems design and implementation practice. This person would have at least three years of experience in designing systems that distributed digital media content and, from an engineering perspective, would be knowledgeable about over-the-air broadcast, cable, and satellite distribution and broadcast systems. As a systems designer and team leader, this hypothetical person would be capable of directing tasks in hardware engineering, computer architecture, and software engineering. In reaching this opinion as to the qualifications of the hypothetical person of ordinary skill in the art, I have considered the types of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level of active workers in the field.

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## VII. DESIGN PROCESS

20. Before beginning a general discussion of the questions that I have been asked to address, it will be helpful first to consider briefly the conventional processes involved in the design of hardware and software in January, 1991. This will provide a foundation for the discussions to follow by making clear that there are many decisions to be made in the system design process that relate to the purposes of a system and its basic characteristics that are independent of the technology of any patent that might be implemented as part of the design. Thus, those design choices, unless specifically determined by the requirements of a patent, would have been made without involving the level of experimentation that would render such a patent insufficiently enabling; they are part of the normal design process and would have been known to persons of ordinary skill in the art in early 1991.

**A. For hardware**

21. When considering the design of hardware, there are several aspects of the system design that must be specified first to enable the more detailed design of the particular hardware. Among the initial choices to be identified are the functions to be performed by each element or device within the system or piece of equipment, the interconnection protocols to be used to connect elements of the system or device together, and any physical constraints on the hardware unit.

22. The functional specifications will include the types of signals or information to be communicated to the device on its input(s), the types of signals or information to be communicated by the device on its output(s), and the types of manipulations to be carried out on the signals or information in the process contained within the device.

23. Interconnection protocols include the voltage levels of the signals on the input(s) and output(s) of the device, the frequency ranges and forms of modulation, plus the interface and connector types to be used. Also included may be the standards to be used to define the interfaces, the order in which signals are exchanged between devices, and the like.

24. Physical constraints include such factors as the space available for the hardware items, the power available, and limitations on the heat that can be generated by the equipment, mounting arrangements for the gear, locations in which it will be placed, and similar considerations.

25. Making choices of the sort described would be considered part of a routine system design process and would not constitute experimentation, but rather the development half of the research and development process, of which experimentation is the research half. Making design choices of this sort can follow an iterative process as the system design is refined, still without constituting experimentation.

**B. For software**

26. When considering the design of software, there also are several aspects of the system design that must be specified first to enable the more detailed design of the particular software. Among the initial choices to be identified are the functions to be performed by the overall software structure, the software interface protocols to be used to exchange data between the software and other system elements, and any limitations on the operation of the software. Also to be decided are

the choices for programming languages to be used in writing the program code for various portions of the software structure.

27. The functional specifications will include the structure of the data and the types of data to be communicated to the software at its input, the structure of the data and the types of data to be communicated by the software at its output, and the types of manipulations of the data to be performed in the algorithms to be executed by the software.

28. The software interface protocols specify such characteristics as the format and packaging of the data exchanged by the software with other system elements, the control functions (handshaking) executed by the software to enable exchange of the data with other system elements, the paths to be followed by the data in moving from one part of the system to another, and the like. Standard software interfaces available in the industry and ones designed specifically for the system (such as application programming interfaces – APIs) often are specified.

29. Limitations on the operation of the software might include time constraints on the delivery of output data following receipt of input data, constraints on the amount of memory that can be used for different functions, constraints on the load placed on the hardware on which the software will run, and the like.

30. Choices of programming languages will affect such factors as the speed and efficiency with which the program instructions can be written, the efficiency with which the code will run on the target system, and the level of detail with which the functionality of the software, and the hardware on which it runs, can be controlled.

31. As in the hardware case, making choices of the sort described would be considered part of a routine system design process and would not constitute experimentation, but rather the development half of the research and development process, of which experimentation is the research half. Making design choices of this sort can follow an iterative process, as the system design is refined, still without constituting experimentation.

## VIII. QUESTIONS TO BE ADDRESSED

32. I have been asked to address two fundamental questions and a series of additional questions. The fundamental questions are: (1) Would the disclosure of the '992 patent application

reasonably have conveyed to one of ordinary skill in the art, in January, 1991, that the inventors were in possession of listed components of the "transmission system" and of the "receiving system"? and (2) Could one of ordinary skill in the art, using his knowledge and the disclosure of the '992 patent, in January, 1991, have made and used the listed components of the "transmission system" and of the "reception system" without undue experimentation?

The listed components of the transmission system are:

a. Source material library 111;
b. Identification encoder 112;
c. Converter 113;
d. Time encoder 114;
e. Precompression processor 115;
f. Compressor 116;
g. Compressed data formatter 117;
h. Compressed data library 118;
i. Transmission format conversion CPUs 119;
j. Library system control computer 1123; and
k. Library access interface 121.

The listed components of the reception system are:

a. Receiver format converter 202;
b. Storage 203;
c. Data formatter 204;
d. Decompressors 208 and 209;
e. Converters 206;
f. User/computer interface 207; and
g. Reception confirmation function.

33. In addition to these, there are twelve further questions, some of which have been divided into two parts, to which I have been asked to respond. In the interest of efficiency and economy, they are not repeated here, but are included below as introductions to their answers.

## IX. INFORMATION PROVIDED TO ME BY COUNSEL

34. I was informed by counsel for Acacia that the following applies to my consideration of the questions above:

1. The filing date of the application which matured into each of the Yurt patents is January 7, 1991.

2. Patents are not production documents and therefore a patent application need not include (and preferably omits) what is already known and available to one of ordinary skill in the art as of the filing date of the patent application.

3. Whether experimentation is undue is based on consideration of the following illustrative, but not mandatory, factors, including: (1) the quantity of the experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.

a. When the input, output, and functions of a software program are disclosed in the patent document, writing code for such software is normally within the skill of the person of ordinary skill in the art, and does not require undue experimentation. The design of superior software, or whether each programmer would work out the details of the software in the identical way, is not relevant to the question of undue experimentation.

b. A considerable amount of experimentation is permissible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed.

4. To reasonably convey to one of ordinary skill in the art that the inventors were in possession of the invention at the time of the filing of the patent application, the disclosure need not describe the claimed subject matter in exactly the same terms as those used in the claims; it must simply indicate to one of ordinary skill

in the art that the inventors had invented what is now claimed. The disclosure can be inherent, i.e., necessarily present in the disclosure such that one of ordinary skill in the art would recognize such disclosure. The disclosure includes the specification, the figures, and the originally-filed claims.

5. The Court construed "transmission system" to mean "the configurable, interconnected assemblage of components labeled and described in the specification as 'transmission system 100,' a detailed block diagram of which is shown on Figures 2a and 2b."

6. The Court construed "receiving system" to mean "the configurable, interconnected assemblage of components labeled and described in the specification as 'receiving system 200,' a detailed block diagram of which is shown on Figure 6."

7. The Court construed the "source material library" to mean "a collection of original sources of information."

8. The Court construed the "local distribution system" to mean "a reception system, as previously defined, located geographically close to the subscriber receiving stations (i.e., a receiving device at the subscriber's location) which are coupled to the reception system."

9. The Court construed the "subscriber selectable receiving stations" to mean "receiving device or devices which can be designated by the subscriber."

10. The Court construed the phrase "storing items having information in the source material library" of claim 41 of the '992 patent to mean "an act performed by the transmission system of retaining physical items containing audio information or video information or both as a collection of original sources of information in the source material library."

11. The Court construed the order of the steps of claim 41 of the '992 patent as follows: "a step, which is an antecedent to a proceeding step, must commence before the succeeding step commences, and the antecedent step must finish before the succeeding step can finish."

## X. GENERAL STATE OF THE VIDEO, AUDIO, COMPUTER, DATA COMMUNICATIONS, AND RELATED TECHNOLOGIES IN 1991 AND KNOWLEDGE OF PERSONS OF ORDINARY SKILL IN THE ART

35. At the beginning of 1991, the state of the various technologies required to construct the system of the '992 patent was such that most items could be obtained as off-the-shelf products, and what could not be so obtained was sufficiently well described in the patent specification as to allow its construction without undue experimentation. Some examples follow of the types of equipment and the technologies that could have been applied to implementation of the patent at that time.

36. Video technology was widely available in both analog and digital forms in 1991. By then, it had been 10 years since the fundamental tests had been conducted (by this writer and others) that led to a worldwide standard for digital video. It was then a number of years after the development of the serial digital interface (by this writer and others) that enabled widespread use of the digital video technology by making its application simple through the provision of an easily constructed infrastructure. By that point, analog video technology was mature and was available in both composite and component forms. Similarly, digital video equipment was available in both composite and component types, with a wide array of equipment functions readily accessible off-the-shelf to the system designer.

37. By 1991, high definition television (HDTV) had been demonstrated in the U.S. for ten years, and massive efforts were proceeding in a public/private effort initiated by the FCC, in 1987, to find ways to broadcast HDTV to the public. While somewhat large and expensive by contemporary standards, HDTV equipment was readily available for professional use. Production of content in HDTV formats already was occurring for certain limited applications. HDTV was seeing wide utilization in the production of motion pictures for the creation of special effects. Consumer equipment for HDTV operation was to come in the future.

38. Video recording technology by 1991 supported a number of videotape formats – both professional and consumer. In the professional realm, video recording and playback machines were available at all levels of capability from standard definition, in both component and composite varieties, to high definition – essentially all component. Both analog and digital recording methods

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were in use for both component and composite forms of signals. The videotape machines used a variety of tape types and tape widths to achieve differing levels of performance vs. cost trade-offs. There also were several methods, by then, of video recording on divers forms of optical media – ranging from laserdisc to compact disk formats. The DVD had not yet been invented, though. Recorders and players were readily available for all types of tape and optical formats that ranged from small, manually-operated, single-medium units to large, automated equipment that stored, loaded, and recorded or played many media. Consumer equipment consisted largely of videotape recorders and players and optical disk players.

39. Similar capabilities existed for audio as for video. Both professional and consumer equipment was available in both analog and digital formats. Audio recording and playback were possible using divers tape and disk formats. Professional and consumer interfaces existed to permit interconnecting equipment while retaining signals in digital form. Multi-channel production and recording systems existed to support the production of audio content, and high-quality stereo sound was regularly being produced and distributed to consumers.

40. Digital video compression, by early 1991, was a technology that had developed over the period of a decade or more. It had been implemented for certain commercial applications for several years and was improving sufficiently rapidly that its application to other uses was imminent. It had already been proposed as a solution for the transmission of high definition television over conventional over-the-air broadcast channels,[1] and it was under development for use in cable and satellite systems for distribution of television content to consumers. At that point, equipment was available off-the-shelf for such applications as video conferencing over data communications channels, and integrated circuits to carry out many of the primary functions of video compression coding were available. Integration into larger scale integrated circuits already had begun in order to enable more compact and efficient designs of video encoding equipment.[2]

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[1] "Digicipher™ HDTV System", General Instrument Corporation, Videocipher Division, June 22, 1990, a copy of which is attached hereto as Exhibit C.

[2] Artieri, A. and Colavin, O., "A Chip Set Core for Image Compression", *IEEE Transactions on Consumer Electronics*, Vol. 36, No. 3, August 1990, pp. 395 – 402, a copy of which is attached

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41. By January, 1991, most of the major techniques for video compression that ultimately would be adopted for use in the Digital Television system currently in operation in the U.S. had been published and demonstrated.[3,4,5,6] These included such encoding methods as block-based coding,[7] the discrete cosine transform (DCT),[8] coefficient quantization,[9] motion estimation,[10] motion compensation,[11,12] variable-length and amplitude/run-length coding,[13] buffer rate control,[14] and non-rectangular coefficient scanning. Of course, the complementary methods for decoding of the signals back to video also were known. In addition to the methods based fundamentally on the

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hereto as Exhibit D.

[3] Rao, K.R., Yip, P., *Discrete Cosine Transform: Algortihms, Advantages, and Applications*, a copy of the cover page and copyright page are attached hereto as Exhibit E.

[4] Huffman, D.A., "A Method for the Construction of Minimum-Redundancy Codes", *Proceedings of the I.R.E.*, September 1952, pp. 1098-1101, a copy of which is attached hereto as Exhibit F.

[5] Artieri, A. and Colavin, O., "A Chip Set Core for Image Compression", *supra*, n 2; Exhibit D.

[6] "Digicipher™ HDTV System", *supra*, n 1; Exhibit C.

[7] Ahmed, N., Natarajan, T., and Rao, K.R., "Discrete Cosine Transform", *IEEE Transactions on Computers*, Vol. C-23, No. 1, January 1974, pp. 90-93, a copy of which is attached hereto as Exhibit G.

[8] *Id.*

[9] Shalkhauser, M., Whyte, W.A., "Digital Codec for Real-time Processing of Broadcast Quality Video Signals at 1.8 Bits/Pixel", *Global Telecommunications Conference, 1989*, Vol.1, November 27-30, 1989, pp. 242-249, a copy of which is attached hereto as Exhibit H.

[10] "Digicipher™ HDTV System", *supra*, n 1; Exhibit C.

[11] Ninomiya, Y., Ohtsuka, Y., "A Motion-Compensated Interframe Coding Scheme for Television Pictures", *IEEE Transactions on Communications*, Vol. 30, No. 1, Part 1, January 1982, pp. 201-211, a copy of which is attached hereto as Exhibit I.

[12] Ericsson, S., "Fixed and Adaptive Predictors for Hybrid Predictive/Transform Coding", *IEEE Transactions on Communications*, Vol. 33, No. 12, December 1985, pp. 1291-1302, a copy of which is attached hereto as Exhibit J.

[13] "Digicipher™ HDTV System", *supra*, n 1; Exhibit C.

[14] Chen, W.S., Pratt, W., "Scene Adaptive Coder", *IEEE Transactions on Communications*, Vol. 32, No.3, March 1984, pp. 225 – 232, a copy of which is attached hereto as Exhibit K.

DCT, other basic methods such as vector quantization[15,16] and sub-band coding using wavelet transforms[17,18] were known and had been published.

42. To underscore this state of the technology of digital video compression, in the summer of 1990, I attended a meeting of the FCC Advisory Committee on Advanced Television Service (ACATS), Systems Subcommittee Working Party 1 (SS/WP1) on Systems Analysis, at which representatives of the General Instrument Corporation (GI) presented the technology of its Digicipher HDTV System for pre-certification for testing as part of the work of the Advisory Committee. During that presentation, most of the technologies related to the DCT approach to digital video compression listed in the preceding paragraph were disclosed and discussed. A document was provided in advance to those in attendance, explaining the operation of the proposed system and the uses of the various technologies by it.[19] A copy of that document, which has been in my library since the time of the meeting described, is attached hereto as Exhibit C. I should note that the GI presentation at the meeting in June, 1990, changed the course of the Advisory Committee work and of television history; by the end of 1990, three of the other system proponents had switched their proposals from analog to fully digital technologies – all of them using many of the basic techniques listed above. Once the systems were tested, the remaining analog approaches were eliminated from competition and an exercise was begun to combine the best features from the four remaining digital candidates into what came to be known as the Grand Alliance system.

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[15] Rutledge, C.W., "Vector DPCM: Vector Predictive Coding of Color Images", *Proceedings of the IEEE Global Telecommunications Conference*, September 1986, pp. 1158-1164, a copy of which is attached hereto as Exhibit L.

[16] Krishnamurthy, A.K., Ahalt, S.C., Melton, D.E., and Chen, P., "Neural Networks for Vector Quantization of Speech and Images", *IEEE Journal on Selected Areas in Communications*, Vol. 8, No. 8, October 1990, pp. 1449-1457, a copy of which is attached hereto as Exhibit M.

[17] Daubechies, I., "Orthonormal Bases of Compactly Supported Wavelets", *Communications on Pure and Applied Mathematics*, Vol. XLI, No. 7, October 1988, pp. 909-994, a copy of which is attached hereto as Exhibit N.

[18] Mallat, S.G., "A Theory for Multiresolution Signal Decomposition: The Wavelet Representation", *IEEE Transactions of Pattern Analysis and Machine Intelligence*, Vol. 11, No. 7, July 1989, pp. 674-693, a copy of which is attached hereto as Exhibit O.

[19] "Digicipher™ HDTV System", *supra*, n 1; Exhibit C.

43. Digital audio compression, by early 1991, had reached the stage that the techniques necessary for the first commercial services had been published and demonstrated. Some equipment was available off-the-shelf, while the integrated circuits that would enable commercialization of other methods were becoming available. In particular by the start of 1991, the methods of transform coding using noise masking criteria,[20,21] perceptual entropy coding,[22] minimum redundancy coding,[23] predictive coding,[24] adaptive differential pulse code modulation,[25] sub-band coding,[26] and application of vector quantization[27,28,29,30,31,32,33] and of the DCT[34] to audio were widely known

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[20] Wiese, D., Stoll, G., "Bitrate Reduction of High Quality Audio Signals by Modeling the Ears Masking", Presented at the 89th Convention of the Audio Engineering Society, No. 2970, September 21-25, 1990, a copy of which is attached hereto as Exhibit P.

[21] Johnston, J.D., "Transform Coding of Audio Signals Using Perceptual Noise Criteria", *IEEE Journal on Selected Areas in Communications*, Vol. 6, No. 2, February 1988, pp. 314-323, a copy of which is attached hereto as Exhibit Q.

[22] Johnston, J.D., "Estimation of Perceptual Entropy Using Noise Masking Criteria", International Conference on Acoustics, Speech, and Signal Processing, April 1988, Vol. 5, April 11-14, 1988 pp. 2524 – 2527, a copy of which is attached hereto as Exhibit R.

[23] Nishiguchi, M., Akagiri, K., Suzuki, T., "A New Audio Bit Rate Reduction System for the CD-I Format", Presented at the 81st Convention of the Audio Engineering Society, No. 2375, November 12-16, 1986, a copy of which is attached hereto as Exhibit S.

[24] Atal, B.S., "Predictive Coding of Speech at Low Bit Rates", *IEEE Transactions on Communications*, Vol. COM-30, No. 4, April 1982, pp. 600-614, a copy of which is attached hereto as Exhibit T.

[25] Takahashi, Y., Yamamoto, K., "Study and Evaluation of New Method of ADPCM Encoding", Presented at the 86th Convention of the Audio Engineering Society, No. 2813, March 7-10, 1989, a copy of which is attached hereto as Exhibit U.

[26] Esteban, D., Galand, C., "Application of Quadrature Mirror Filters to Split Band Voice Coding Schemes", 1977 IEEE Conference on Acoustics, Speech & Signal Processing, May 9-11, 1977, pp. 191-195, a copy of which is attached hereto as Exhibit V.

[27] Linde, Y., Buzo, A., Gray, R.M., "An Algorithm for Vector Quantizer Design", *IEEE Transactions on Communications*, Vol. COM-28, No. 1, January 1980, pp. 84-95, a copy of which is attached hereto as Exhibit W.

[28] Buzo, A., Gray, A.H., Gray, R.M., Markel, J.D., "Speech coding Based Upon Vector Quantization", *IEEE Transactions on Acoustics, Speech, and Signal Processing*, Vol. 28, No. 5, October 1980, pp. 562-574, a copy of which is attached hereto as Exhibit X.

[29] Makhoul, J., Roucos, S., Gish, H., "Vector Quantization in Speech Coding", *Proceedings of the IEEE*, Vol. 73, No. 11, November 1985, pp. 1551-1588, a copy of which is attached hereto as Exhibit Y.

among practitioners of the audio compression art.

44. At the start of 1991, well known methods existed for converting nearly all other forms of media and types of performances into recordings on analog or digital media of practically any format. For example, for content stored on film, the conversion process involved use of a machine called a telecine or a system called a film chain. With either of these methods, the film is threaded onto a projector and projected into a television pickup device, with the projection of the film frames synchronized with the scanning of the television image frames. Film transfers thereby occurred in real time, with the length of the material being transferred equaling the amount of time that would be required to carry out the transfer.

45. Other types of media from which it was well known in 1991 how to transfer the content to other media such as analog or digital videotape or audio tape included various other kinds of video and audio tape formats, optical disks, and the like. In addition, it was well known how to scan paper media, photographs, and film foils – e.g., containing documents, books, images, or presentations for overhead projection – to produce digital images that could be stored on any appropriate media. Moreover, it also was well known at that time how to record the sounds produced by musical instruments to any appropriate media.

46. By 1991, personal computers had been widely available for over ten years, and the technology was on at least its fourth generation. Machines with the latest technology for IBM-

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[30] Ahalt, S.C., Krishnamurthy, A.K., Chen, P., Melton, D.E., "Competitive Learning Algorithms for Vector Quantization", *Neural Networks*, Vol. 3, Issue 3, 1990, pp. 277-290, a copy of which is attached hereto as Exhibit Z.

[31] Lutrell, S.P., "Derivation of a Class of Training Algorithms", *IEEE Transactions on Neural Networks*, Vol. 1, No. 2, June 1990, pp. 229-232, a copy of which is attached hereto as Exhibit AA.

[32] Krishnamurthy, A.K., Ahalt, S.C., Melton, D.E., and Chen, P., "Neural Networks for Vector Quantization of Speech and Images", *supra*, n 16; Exhibit M.

[33] Lee, C-T., Peterson, A.M., "Adaptive Vector Quantization Using a Self-Development Neural Network", *IEEE Journal on Selected Areas in Communications*, Vol. 8, No. 8, October 1990, pp. 1458-1471, a copy of which is attached hereto as Exhibit BB.

[34] Makhoul, J., "A Fast Cosine Transform in One and Two Dimensions", *IEEE Transactions on Acoustics, Speech, and Signal Processing*, Vol. 28, No. 1, February 1980, pp. 27-34, a copy of which is attached hereto as Exhibit CC.

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compatible PCs used the Intel 80486 microprocessor,[35,36] with a 50 MHz clock speed,[37] had a memory size of 8 Megabytes (MB),[38] and included hard drives with a storage capacity of 320 MB.[39] Common display resolution was 1024 x 768 pixels.[40] Much greater processing capability and speed, memory size, and hard drive storage capacity were available contemporaneously on minicomputers, mainframe computers, and supercomputers. The most popular minicomputers, for instance, were in the VAX series from Digital Equipment Corporation (DEC).

47. Operating systems of the time very often were written for particular types of processors. For example, the DOS and Windows operating systems ran on IBM-compatible machines based on Intel or compatible microprocessors,[41] and the VMS operating system ran on the VAX minicomputers from DEC. The UNIX operating system, which originated at Bell Labs, however, ran on a range of computers with a variety processors.[42] Each operating system had its own file system that determined how files were named, indexed, and placed on storage media such as hard disks. The file systems had names such as FAT (for File Allocation Table), used by DOS and Windows, and FFS (for Fast File System) used by UNIX.

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[35] "Intel486™ Processors and Earlier", http://www.intel.com/pressroom/kits/quickreffam.htm, a copy of which is attached hereto as Exhibit DD.

[36] Polsson, K., "Chronology of IBM Personal Computers", http://www.islandnet.com/~kpolsson/ibmpc/ibm1987.htm, a copy of which is attached hereto as Exhibit EE.

[37] "Intel486™ Processors and Earlier", *supra*, n 35; Exhibit DD.

[38] Polsson, K., "Chronology of IBM Personal Computers", *supra*, n 36; Exhibit EE.

[39] *Id.*

[40] Polsson, K., "Chronology of Personal Computers--1990", http://www.islandnet.com/~kpolsson/comphist/comp1990.htm, a copy of which is attached hereto as Exhibit FF.

[41] Polsson, K., "Chronology of Microsoft Windows Operating Systems – 1981-1989", http://www.islandnet.com/~kpolsson/windows, and "Chronology of Microsoft Windows Operating Systems – 1990-1993", http://www.islandnet.com/~kpolsson/windows/win1990.htm, a copy of both is attached hereto as Exhibit GG.

[42] Computer History Museum, "Timeline of Computer History", http://www.computerhistory.org/timeline/?category=sl, a copy of which is attached hereto as Exhibit HH.

48. Wide ranges of software applications, programming languages, and software development tools were available at the start of 1991. In the database category alone, programs were available in the form of dBase from Ashton-Tate, DB2 from IBM, and Informix, Oracle, and Sybase from companies having the same names as their products. Many of these products used the Structured Query Language (SQL), which was first standardized in 1986, as the interface for managing the information they contained. The more capable of these products used a Relational Database Management System (RDBMS) approach that provided for great flexibility and scalability in the organization and size of the information they included. Programs could be written in high level programming languages with names like FORTRAN, COBOL, BASIC, Forth, Pascal, and numerous others, with the most prevalent programming languages being C and its progeny.[43]

49. A variety of technologies for data delivery to consumers was available at the beginning of 1991. These included digital subscriber line (DSL) methods over the common carrier copper wire telephone infrastructure, delivery over cable television coaxial cable networks, use of various types of digital common carrier circuits, some of which employed coaxial and fiber optic cables, as well as more conventional methods using modulator/demodulators (modems) on conventional voice grade telephone lines. In addition to applying these techniques to delivery directly to homes, many of them also could be applied to delivery of data signals to intermediate distribution points, such as to cable headends when cable systems were to form the method for final delivery to the home (i.e., "the last mile" connection). Beyond these terrestrial methods, signals could be sent over satellite transponders for direct delivery of data to homes spread over broad regions.

50. Some of the data communications channels available in early 1991 were highly reliable and provided two-way communications so that delivery could be confirmed and missing data could be resent. Other types of data communications channels were one-way, and typically those types of channels also were the least reliable when considering the channel characteristics alone. Methods had been developed by the start of 1991 to mitigate the effects of transmission

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[43] Computer History Museum, "Timeline of Computer History", *supra*, n 42; Exhibit HH.

through the various sorts of data channels. For example, for reasonably good two-way channels, methods were available similar to those used as part of the TCP/IP data protocol.[44] TCP/IP includes methods for determining whether data was accurately received and sends acknowledgement (ACK) messages from the receiving end to the transmitting end for data correctly received. TCP/IP also resends data from the transmitting end to the receiving end when a negative acknowledgement (NAK) is sent back from the receiver to indicate incorrectly received data or when no acknowledgement is received at the transmitter for particular data after a certain period of time.[45]

51. For one-way channels, by the beginning of 1991, methods had been developed to add redundant data to the transmissions so that errors could be repaired at the receiving end of a link through techniques called error correction coding (ECC) and forward error correction (FEC). An example of such a technique is the scheme known as Reed-Solomon (RS) error correction coding.[46,47] RS codes are block codes that enable correction of a number of errors that occur in individual bytes within a block of bytes that are coded together. By 1991, RS coding was widely used in the compact disc format as well as in a wide range of long-distance data communications applications. It also was included in the system presented to the FCC Advisory Committee by General Instrument in the summer of 1990 that I described previously. Typically, RS coding was (and is) used as a so-called "outer code" in combination with another technique such as convolutional coding as an "inner code," with an interleaver between them. These techniques all were known and in use from at least the 1970s onward.[48]

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[44] Internet Engineering Task Force (IETF) Request for Comment (RFC) 793 "Transmission Control Protocol", September, 1981, a copy of which is attached hereto as Exhibit II.

[45] "Introduction to TCP/IP", February 2, 1995, http://www.yale.edu/pclt/COMM/TCPIP.HTM, a copy of which is attached hereto as Exhibit JJ.

[46] Reed, I.S., Solomon, G., "Polynomial Codes Over Certain Finite Fields", *Journal of the Society for Industrial and Applied Mathematics*, Vol. 8, No. 2, 1960, pp. 300-304, a copy of which is attached hereto as Exhibit KK.

[47] Wicker, S.B., Bhargava, V.K., "An Introduction to Reed-Solomon Codes", *Reed-Solomon Codes and Their Applications*, John Wiley & Sons, Inc., December 1991, Chapter 1, pp. 1-16, a copy of which is attached hereto as Exhibit LL.

[48] Bell Telephone Laboratories, Inc., *Transmission Systems for Communications*, Fifth Ed., 1982,

52. Of course, it is assumed that the hypothetical person of ordinary skill in the art would have had knowledge of all of the available equipment and the techniques just described and could have brought them to bear on the implementation of the patent at issue. Indeed, there were many more components, subsystems, and systems that would have been available to the person of ordinary skill in the art of the patent at the start of 1991 that could have been applied to the implementation of the patent at that time, and some of them will be described in the sections of this report that follow.

## XI. TRANSMISSION SYSTEM

53. As noted previously, I have been asked a series of questions regarding the Transmission System and the Reception System of the patent. The following subsections of this section will deal with the subsystems of the Transmission System. The next major section will deal with the Reception System. With respect to each of the subsystems, the questions to be addressed are whether the disclosure of the '992 patent reasonably would have conveyed to one of ordinary skill in the art in January 1991 that the inventors were in possession of the respective subsystems and whether one of ordinary skill in the art, using his or her knowledge and the disclosure of the '992 patent, in January, 1991, could have made and used the respective subsystems without undue experimentation.

54. To answer these questions, a thorough analysis of the specification of the '992 patent was conducted. The analysis identified, for each of the subsystems described by the patent, the inputs, the functions, and the outputs of the individual subsystems. In addition, the functions of all separately identifiable processes described by the patent were identified. The complete results of the analysis are provided in Exhibit B hereto. Those results are presented in the form of a table. For ease of understanding, the table is divided into major sections along both axes. Along the vertical axis, the major divisions separate the subsystems and the identifiable processes. Along the horizontal axis, the major divisions separate the functions, the inputs, and the outputs of the respective subsystems.

55. For each of the respective collections of information about each of the subsystems or

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Chapter 33, pp. 787-820, a copy of which is attached hereto as Exhibit MM.

processes, references are provided to the columns and lines or to the figure numbers where each of the particular characteristics is found within the patent specification of U.S. Patent No. 5,132,992 (the '992 patent). It is worth noting that nearly all references are to the text and that only a few of the determinations depend on the figures. For the inputs to the subsystems, the sources of those inputs are indicated. For the outputs from the subsystems, the destinations of those outputs are provided.

56. In addition to the functions, inputs, and outputs for each subsystem, whether the respective subsystem is mandatory, inherently required, or optional also is indicated. Mandatory means that the item is described in the text of the specification as being required. Inherently required means that I have made a determination that the item is required for any embodiment of the patent to function as described. Optional means that the item may not be required in all cases. For each of these determinations, references are provided. It should be noted that, in some cases, items are indicated as being inherently required in certain embodiments and optional in other embodiments.

57. Further information included for many of the subsystems is whether they are identified in the patent under different names and what those names are, as indicated in the column labeled "alias." When aliases are indicated, references are provided for where they occur within the patent. Also, when subsystems constitute parts of other subsystems, the identification number used within the patent for the larger subsystem is indicated in the column labeled "part of."

**A. Source Material Library 111**

58. As indicated in the table of Exhibit B, the inputs, functions, and outputs of the Source Material Library are disclosed in the specification of the '992 patent. The Source Material Library provides temporary storage for items to be entered into the transmission system and inherently includes the electro-mechanical equipment necessary to convert the contents of the various forms of media to, or to capture the essence of physical items on, media that are compatible with the various forms of input to the rest of the Transmission System that are described in the specification. Also inherent in the description of the Source Material Library are the methods for inputting the various media and/or physical items the contents or essence of which are to be transferred to media

compatible with the rest of the system during the period that they are temporarily stored there.

59. For some examples, the placing of film reels on shelves in storage systems, the removal of those film reels from their storage containers, the threading of those films onto projectors, the projecting of those films onto film scanners in telecines or into television cameras in film chains, and the recording of the outputs of those telecines or film chains on one or another format of analog or digital videotape all were well known functions in early 1991 and would have been known to one of ordinary skill in the art of the '992 patent. The placing of television programs recorded on quadruplex videotapes on shelves in storage systems, the removal of those videotapes from their storage containers, the threading of those videotapes onto videotape machines, the playing back of those videotapes on the videotape machines, and the recording of the outputs of those videotape machines on one or another different format of analog or digital videotape all were well known functions in early 1991 and would have been known to one of ordinary skill in the art of the '992 patent. The placing of books on shelves in libraries, the removal of those books from their shelves, the placing of those books onto image scanners, one page at a time, the recording of the outputs of those image scanners with one page of book recorded in one frame of video on analog or digital videotape, all were well known functions in early 1991 and would have been known to one of ordinary skill in the art of the '992 patent.

60. In the case of every form of medium and every physical instrumentality discussed in the '992 patent, a similar statement could be made about the process for placing items in storage, removing them from storage and possibly their storage containers, and converting their contents to forms that could be represented on analog or digital videotape. To emphasize this point, from 1984 – 85, I was president of a company called Imagex Corporation. One of the activities of Imagex was the development of methods for converting large volumes of driver license photographs from paper images to video images, storing one image per frame, and identifying the locations of the images of each of the many drivers by storing in a database the time positions on videotapes and later writable optical disks at which they were stored. Similar techniques already had been used by others to catalog the contents of museums on a frame-by-frame storage basis on various video media. The storage of individual items on separate frames in a sequence thus was not a new scheme by 1991.

61. In many cases, by the start of 1991, it would have been possible to automate the processes of retrieving items from storage and playing them back on appropriate machines, scanning them on appropriate scanners, and the like. For example, there were automated tape machines that could store large volumes of videotapes, load the tape cassettes, thread the tapes, and initiate playback under control of computers. There were other machines that could store large volumes of optical disks, load the disks – like a jukebox – onto playback decks, and initiate playback under control of computers. There were yet other machines that could hold large volumes of documents, feed those documents to scanners – one document or page at a time, and scan the contents of the documents, page-by-page, under control of a computer. Similar types of automated media and content handling devices were available for most, if not all, of the media and physical object types described in the '992 patent with respect to inclusion in the Source Material Library.

62. It is significant to note that, if these types of automated playback or document retrieval devices were applied to the Source Material Library, since its storage was described as temporary – to meet the needs of getting content into the Transmission System so that the content could be permanently stored in the Compressed Data Library – there would still have to be system operators involved to load and unload the automated storage and content retrieval devices. There also would have to be system operators involved to decide what content to make available through the system and to store in the Source Material Library long enough for it to be processed for longer term storage and availability.

63. There is no requirement in the '992 patent specification that a single Source Material Library be able to store and process all of the different types of media and content sources that are described as potentially used in conjunction with such a library. Indeed, it would be expected that different embodiments of the system described would include the equipment necessary for handling only the types of media or content with which they were expected to work. Thus, various Source Material Libraries, which, according to the patent specification, could be interconnected with one another using any available method, could be set up to specialize in certain types of media or other content sources. One might be for film, for instance, while another was for optical disks and yet another for audio compact discs. Each of these specialized systems then could apply the best

practices for handling of the types of media or objects for which it was specialized. Given the provisions in the patent specification for the linking of Source Material Libraries and their ability to communicate by any available means, one or many of them could be managed from a single Identification Encoder, and each one of them could be managed from one or many Identification Encoders.

64. In consideration of all of the foregoing with respect to Source Material Libraries, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**B. Identification Encoder 112**

65. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Identification Encoder are disclosed in the specification of the '992 patent. The Identification Encoder is used to manage the retrieval of information for items stored in one or more Source Material Libraries and to assign unique identification codes to the items that are retrieved. The Identification Encoder performs storage encoding, which includes capturing indications of whether content items are to be copy protected and collecting from system operators program notes information (now called "metadata") about the items being processed, and stores the collected information in the master item database. It assigns file addresses to the items as part of the identification encoding process. It keeps the master item database up to date and enables the system operator to revise and add information about items stored in the system. It can process inter-library transfers so that the items transferred can be included in the Compressed Data Library of the Transmission System of which it is a subsystem.

66. The functions of the Identification Encoder are not very different from some of the functionality that existed at the time of the invention in broadcast television automation systems. For example, in the mid-1970s, I operated and worked on design improvements of such a system

that was in use at KYW Television in Philadelphia. That system was typical of such systems in use at a number of the more advanced television stations across the country. With that system, when items for broadcast arrived at the station (typically by courier shipment), they were assigned a unique identifier called a "house number," having a scope of uniqueness that extended across the station's operations. (For more information on the concept of scope of uniqueness and related matters, please see the discussion on "Unique Identification Codes" on pages 16 – 18 in my expert report of October 20, 2004, in the current case.) Personnel in the Traffic Department entered information into a computer database about the characteristics of the program or commercial material that had arrived, and that information was associated with the material through the house number. The media containing the content was labeled with the house number, and, when it came time to play back the content on the air, the house number was entered into the computer automation system to indicate where the content was loaded onto a playback machine so that the automation system could start the machine and switch it on air at the appropriate time, as indicated in the computerized program schedule.

67. A person of ordinary skill in the art of the patent, at the start of 1991, would have been aware of the sorts of systems on which I worked in the mid-1970s and, indeed, of the improvements to such systems that had taken place over the intervening decade and a half. For instance, by 1991, computer processing capability had advanced to the point that networked personal computers could be used in place of the minicomputers that were used in the '70s. Display technology had advanced, as had such system design methods as structured programming. Thus, the Identification Encoder contemplated by the '992 patent would have been much easier to implement in early 1991 than had been the comparable systems of the earlier era.

68. In consideration of the foregoing with respect to an Identification Encoder, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the

processes of system design that were normal for the development of such technological objects. This is particularly true since the functions of the Identification Encoder are largely based upon software functionality, for which only the inputs, functions, and outputs are necessary to create a presumption of enablement, given the instructions I have received.

**C. Converter 113**

69. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Converter are disclosed in the specification of the '992 patent. The purpose of the Converter is to accept at its inputs the analog or digital signals carrying the information data retrieved from items stored in one or more Source Material Libraries, in whatever formats they might be, and to output that data in whatever format was selected for input to the Compression subsystem of the particular embodiment of the Transmission System, such as, for instance, the format described in the patent. The Converter subsystem therefore consists of one or several conversion functions, some of which may be layered upon one another, depending mostly upon the particular form of the input signals. Because it generally is not easy to mix audio and video onto the same interface in the analog domain, analog inputs to the converter likely would be over separate connections for audio and video. Conversely, for digital signals, it is possible to embed audio within a video data stream, so digital inputs could be over separate inputs for audio and video or over a single input when the audio from the source is embedded in the video. Some of the functions that are possible in the Converter are likely to be unneeded in certain embodiments because of the match that already would exist between the format of the data coming from the Source Material Library and the input requirements of the Compression subsystem. The specific configuration of the converter in any particular embodiment of the invention would depend on the types of source materials and signals for which the system was designed (e.g., analog and/or digital, audio only, video only, or audio and video) and on the output format predetermined to match the input to the Compression subsystem on that embodiment (such as the output format described by the inventors, which was one of several commonly used data arrangements during the decades prior to the filing of the patent).

70. Given the data rates involved, in the early 1991 time frame, the Converter would have been constructed from hardware components. Examples of the types of hardware potentially

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required for digital source signals are voltage level translators for digital data signals, serial-to-parallel and parallel-to-serial converters for digital data signals, small data buffers, and data clock generators. Examples of the types of hardware likely required for analog source signals are analog-to-digital (A/D) converters for audio channel data rates and A/D converters for video channel data rates. Some of the same sorts of components as used in the digital source signal case also might have been needed on the outputs of the A/D converters used with analog inputs.

71. All of the components necessary to construct the Converter, in any of its possible configurations, were readily available at the start of 1991. For example, the components needed to interface digital data sources in the Source Material Library to the input of the Compression subsystem all were readily available in a number of standard integrated circuit technologies starting at least by the mid-1980s and in certain of the integrated circuit (IC) technologies much earlier than that. With respect to the A/D converters for both audio and video sample and data rates, such devices were available in the early 1980s at the latest, with improved devices available by the start of 1991.

72. To underscore this availability, in 1981, together with others, I conducted tests of various video coding parameters to determine the values that would be used in the first international digital television coding standard. At that time, there were available, as off-the-shelf components, circuit boards that provided the A/D converter function for video bandwidths, sample rates, and data rates. In the mid-1980s, I conceived the scheme that led to a standard for a serial digital interface (SDI) to interconnect equipment based on the earlier international digital television coding standard using a single coaxial cable interface. As a consequence, there were in the marketplace, by later in the mid-1980s, ICs that did parallel-to-serial and serial-to-parallel conversions at video speeds. All of the other IC functions necessary to build equipment of the sort described for the Converter were similarly available in the marketplace.

73. On the audio front, the Compact Disc digital audio system went into production in 1982. It followed on the progress that had been made in digital audio recording and production over the decade or more prior to that point. Digital audio conversion devices back and forth to analog had been included for years previously in audio consoles that were used for producing the recorded

material that was distributed first on analog media and later on digital media.

74. A person of ordinary skill in the art of the patent, in early 1991, would have been aware of the development of the digital television standard in the early-1980s and of the improvements to such systems that had taken place over the decade since. That person would have been aware of the components available off the shelf to implement systems built around the international digital television standard and the serial digital interface. Similarly, that person would have been aware of the digital audio standards and the components necessary to build systems using them. That person also would have known of the components needed to construct the digital interfaces described for the Converter.

75. In consideration of the foregoing with respect to a Converter, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**D. Time Encoder 114**

76. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Time Encoder are disclosed in the specification of the '992 patent. The purpose of the Time Encoder is to assign relative time markers to audio and video data as it passes from the Converter output to the Precompression Processor input. In doing so, it affixes to the frames of video and audio data that traverse it values representing time that individually identify each frame, establishing their order and relating audio frames to video frames having the same time values. Associating time values with each of the frames in the audio and video data has the result of making each such frame separately and individually identifiable and accessible. It also permits realigning audio and video so that they can be reproduced in synchronization with one another, even if they have been separately stored, processed, and replayed. The same would be true for other forms of data – for example, closed captioning data – if it had been marked with time values matching those applied to the video and/or

audio frames with which it was to be associated and in synchronization with which it was to be reproduced.

77. Time encoding was a well known technique in the television, film making, and audio recording industries at the start of 1991. Time encoding in those industries used a time code standard developed by the Society of Motion Picture and Television Engineers (SMPTE) and first adopted in the late 1960s. The SMPTE Time Code was and is widely used to enable editing of video and audio material and to permit reestablishing the time relationships between video and audio when they have been separately processed (so-called "double system" production and/or post production). SMPTE Time Code marks every frame of video and corresponding period of audio with a value indicating hours, minutes, seconds, and frames. It can count up to 23:59:59:29 before rolling over to start again at 00:00:00:00. SMPTE Time Code can be used to indicate time of day ("wall clock time"), or it can be applied as an indicator of time relative to some event, such as the starting point of a recorded program.

78. Several methods were available for affixing (or "binding") SMPTE Time Code to video and audio data in the 1991 timeframe. These included provisions for placement of the time code in one of several forms on recording media such as videotape and audio tape and the incorporation of data representing the time code values into data structures of video and audio content that were coded in digital form. There were even methods of embedding the digital time code values in analog representations of video and audio material. A number of SMPTE standards issued by 1991 documented the time code itself and a number of ways in which it could be applied. There also were documents adopted by other standards development organizations (SDOs) that provided mechanisms for carriage of SMPTE Time Code – SDOs such as the Audio Engineering Society (AES) and the MIDI Manufacturers Association (MMA), which has responsibility for the Musical Instrument Digital Interface (MIDI). The AES developed methods for carriage of SMPTE Time Code through its standard digital audio interface (AES-3) and also was the first body where the MIDI standard appeared in 1982. Responsibility for MIDI eventually moved to MMA, where the SMPTE Time Code was extended to form MIDI Time Code (MTC), which provides for sub-frame resolution and hence more timing precision.

79. A person of ordinary skill in the art of the patent, in January, 1991, would have been aware of the development of SMPTE Time Code in the late-1960s and of the MIDI Time Code in the 1980s. That person would have been aware of the various methods for applying both SMPTE and MIDI time codes and of the components that were available off the shelf to implement systems built around those time codes. That person also would have understood the technology of the time codes used in the television and electronic music industries along with that of earlier time codes (such as the Inter-Range Instrumentation Group – IRIG – time codes), used for such applications as missile range control and telemetry. Thus, that person of ordinary skill in the art of the patent would have had the knowledge necessary to adapt the existing time encoding methods and to construct an appropriate time encoder if off the shelf hardware then available were not exactly what was required in a particular embodiment of the technology of the patent. (By the start of 1991, computing hardware and software had developed to the point that the time encoder could have been implemented either in hardware or in software.) That person also would have understood how to associate the encoded time values with the video frames and audio sample periods they identified and how a series of time code values could define the sequence of such frames and sample periods that were members of a unified group of addressable data blocks.

80. In consideration of the foregoing with respect to a Time Encoder, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, at the start of 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**E. Precompression Processor 115**

81. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Precompression Processor are disclosed in the specification of the '992 patent. The Precompression Processor comprises an Audio Precompression Processor and a Video Precompression Processor, the purpose of which is to optimize audio and video data for compression processing prior to their

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reaching the Compressor inputs and to buffer the audio and video data for compression processing. In doing so, the Audio Precompression Processor prepares the audio for compression by optimizing the sample rate and word length and by packaging the audio data in frames to enable its treatment as addressable packets. The Video Precompression Processor prepares the video for compression by converting the aspect ratio and frame rates to match the input requirements of the Video Compressor and by optimizing the sample rate of the video data. Both the Audio and Video Precompression Processors then buffer the audio and video data, respectively, so that each can be accessed over a window of time for treatment by its corresponding compressor.

82. The function of the Audio Precompression Processor is to prepare the audio data for compression by optimizing several of its characteristics so that the compression process to follow can obtain the best results of which it is capable. It does this preparing of the audio data by changing the sample rate, if necessary, and setting the word length of the samples. The patent language describes the process of adjusting the sample rate as one of "transcoding" incoming audio information. More formally, transcoding of audio is the process of resampling the data, so that the samples are changed to new positions in time between the samples originally supplied, with the result that the sample rate is modified.

83. An example of the need for resampling would be the case when audio from a Compact Disc (CD) is input to the system, but the system runs internally at a different sampling rate. The standard for CD audio sampling is 44.1 kilo-samples per second. The system might run at 48 kilo-samples per second, a common rate for professional applications. The equipment for making such changes was in wide use in the late 1980s and was often described as a "gearbox" because of the fixed ratio between input and output sampling rates and the resulting relocation of the sample points in time. Also widely used in the 1980s was equipment for operating with the previously-mentioned AES-3 audio interface standard at either of two word sizes that the standard supports – 16-bit words and 20-bit words.

84. An additional function of the Audio Precompression Processor is the buffering of the audio data so that the Audio Compressor could access audio data covering a period of time and use that data to support the audio compression process. Buffering takes place by storing data in a

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memory, and both the amount of storage required and data rate are relatively low for audio data. Thus, in early 1991, implementing the buffering function would have been a fairly simple task in hardware with widely available components or could have been carried out with software in either a dedicated computer or a personal computer. In fact, all of the processing functions described for the Audio Precompression Processor could have been carried out using Digital Signal Processor (DSP) integrated circuits of the sort that had been widely available from Texas Instruments since their introduction in 1983.

85. The function of the Video Precompression Processor is to prepare the video data for compression by modifying several of its characteristics, if necessary, so that the compression process to follow can obtain the best results of which it is capable. In particular, the Video Precompression Processor converts the aspect ratio of the image and the frame rate of the video to match those characteristics to those of the compression subsystem to follow, and it also can adjust the sample rate to optimize it for the video compressor. In adjusting the aspect ratio, which expresses the relationship between the width and height of an image, the Video Precompression Processor can apply a background around any inactive regions in the image that might result, allowing retention of all the content of the original image rather than cropping some and losing it in order to make an image fit a different aspect ratio. It also was capable of using a "best-fit arrangement" of the input image into the output image – a technique generally called "pan and scan" in the television industry.

86. The sorts of functions described for the Video Precompression Processor had been available in equipment for the television industry since the early 1980s. Devices such as the Quantel Digital Production Effects (DPE-5000) and the Vital Squeezoom appeared in the marketplace around 1980 and were capable of adjusting the aspect ratio of the image, adding borders around images, and the like. The pan and scan process had been used for converting the aspect ratio of film to that required for television since the 1970s.

87. Another function of the Video Precompression Processor is the buffering of the video data so that the Video Compressor could access video data covering a period of time and use that data to support the video compression process. Buffering takes place by storing data in a memory,

and both the amount of storage required and data rate are relatively high for video data. Consequently, there were devices built specifically as video frame buffers that were sold for use as subsystems of various types of equipment starting at least by the late 1970s. At that time, I became familiar with the operation of a digital character generation and graphics system made by Aurora Computer Corporation that was based on frame buffers purchased as products from another company. Such frame buffers, or others built from available integrated circuit components specifically for use in the Video Precompression Processor, readily could have been applied in early 1991 to perform the buffering functions described in the '992 patent for the Video Precompression Processor.

88. A person of ordinary skill in the art of the patent, at the beginning of 1991, would have been aware of the equipment and components available in the marketplace – most for a significant period of time by 1991 – that would enable implementation of both the Audio Precompression Processor and the Video Precompression Processor, that is, the Precompression Processor in its entirety. That person would have been aware of the various methods for applying that equipment or those components to implement systems built to achieve the purposes of the Precompression Processor. Thus, that person of ordinary skill in the art of the patent would have had the knowledge necessary to adapt the existing equipment and components to construct an appropriate Precompression Processor if off the shelf hardware then available were not exactly what was required in a particular embodiment of the technology of the patent.

89. In consideration of the foregoing with respect to a Precompression Processor, in both its audio and video aspects, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, at the start of 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

### F. Compressor 116

90. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Compressor are disclosed in the specification of the '992 patent. The Compressor comprises an Audio Compressor and a Video Compressor, the purpose of which is to reduce the amount of data required to represent the audio and video information stored in and transmitted by the Transmission System. The reduction in the amount of data required enables shortened transmission time, faster access time, greater storage capacity, and smaller storage space. To carry out the compression processing, multiple samples of the respective type of data are used by the Audio Compressor and the Video Compressor, with that data organized into frames and multiple frames of data accessible to the appropriate compressor from the buffer in the related Audio or Video Precompression Processor subsystem.

91. By January, 1991, there were numerous techniques available for audio compression. These included quadrature mirror filters applied to split band coding, application of the masking thresholds of the human auditory system, transform coding using perceptual noise criteria, use of noise masking, application of adaptive differential pulse code modulation (ADPCM), predictive filtered ADPCM, predictive coding, μ-law compression, and vector quantization. Each of these methods had been published prior to 1991. Each of them was sufficiently low in complexity that it could have been implemented with the Digital Signal Processing (DSP) integrated circuits that were available at that time. The patent pointed out one implementation of the ADPCM technique that was available off the shelf as a subsystem that could have been applied directly to an embodiment of the patent.

92. With respect to video compression, there were, again, by the start of 1991, numerous methods available. As of that time, publication had occurred regarding such techniques as the discrete cosine transform (DCT), wavelet transforms and coding, vector quantization, motion estimation and motion compensation, interpolative motion prediction, vector differential pulse code modulation, variable length coding, quantization, and zigzag-order scanning of residual coefficients. In the patent itself, there was information provided on an article describing integrated circuits that could be used to create a video compression subsystem based upon the combination of predictive

motion estimation and compensation, interpolative motion prediction, DCT coding of residuals, zigzag-order scanning of residuals, quantization, and variable length coding, with buffer fullness control for constant bit rate transmission. The article on the integrated circuits cited by the inventors provided information on how to construct a pipeline architecture that would permit scaling the system to enable compression of high definition television (HDTV) signals – i.e., signals of a higher quality than were then able to be broadcast.

93. It should be noted that, while commercial products for video compression at a so-called "broadcast quality" level were not yet available off the shelf in January, 1991, there were products available that could be described as having "VHS quality." Since competing with the rental of VHS tapes by consumers was one of the objectives of the invention, the compression hardware that was available for purchase at that point would have been competitive. Moreover, the patent provided information on techniques that could lead to embodiments that not only produced broadcast quality signals but that could produce signals for the next generation of broadcast quality – HDTV – which was only then being considered for adoption as a means for providing broadcast services to consumers.

94. While there were many papers on the subjects of audio and video compression that had been published prior to January, 1991, of which a person of skill in the art of the patent would have been aware, the paper presented to the FCC Advisory Committee in June, 1990, includes information on practically everything a designer of a compression system would have had to take into account to produce a working HDTV and multi-channel audio compression subsystem. Thus, a person of ordinary skill in the art of the patent, at the beginning of 1991, would have been aware of the techniques to be applied and of the equipment and components available in the marketplace that would have enabled implementation of both the Audio Compressor and the Video Compressor, i.e., the Compressor in its entirety. That person would have been aware of the various methods for applying that equipment or those components to implement systems built to achieve the purposes of the Compressor.

95. In consideration of the foregoing with respect to a Compressor, in both its audio and video aspects, it is evident that the inventors disclosed sufficient information about such subsystems

that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, at the start of 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**G. Compressed Data Formatter 117**

96. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Compressed Data Formatter are disclosed in the specification of the '992 patent. The purpose of the Compressed Data Formatter is to prepare the audio and video outputs of the Compressor for storage in the Compressed Data Library. In doing so, it can realign the time relationship between the frames of video and audio data that traverse it, after they have been separately processed in their respective Precompression Processors and Compressors. It may combine the video and audio data into a single file for storage in the Compressed Data Library. It can receive inter-library transfer materials from the Identification Encoder into a Short-Term Storage section that can be included for the purpose. Inter-library transfers include audio and video content in compressed form, along with database records that can be reformatted to match the database scheme used in the particular Transmission System receiving the transfers. Inter-library transfers can be received on digital tapes or via any sort of communications channel and will be input or routed to the Short-Term Storage section.

97. All of the functions of the Compressed Data Formatter depend on software for their implementation. The software, of course, must run on some sort of hardware, but the type of hardware is immaterial to the function, so long as it has sufficient capacity and performance to achieve the processing speed sought by the system designer for that part of the system. All of the functionality, however, will be in software. The software will do such things as combining the video and audio data into whatever file structure has been selected for the system, establishing time alignment between the video and audio data that is to be stored in the files, associating with the audio and video content data the identification and any program notes data that is to be included in the file structure, recognizing whether data from inter-library transfers is compatible with the data

format and structure in use on the local system and converting it to the appropriate format if it is not already compatible, and the like.

98. In consideration of the foregoing with respect to a Compressed Data Formatter, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects. This is particularly true since the functions of the Compressed Data Formatter are largely based upon software functionality, for which only the inputs, functions, and outputs are necessary to create a presumption of enablement, given the instructions I have received.

**H. Compressed Data Library 118**

99. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Compressed Data Library are disclosed in the specification of the '992 patent. The purpose of a Compressed Data Library is to store files containing compressed audio and video data along with other data related to the audio and video content, such as identification data, program notes, and the like. The Compressed Data Library provides the long term storage of content items in a Transmission System and transfers those items to a Transmission Format Conversion CPU for delivery to system users. A Compressed Data Library is an amalgam of hardware and software, with the hardware constituting digital data storage devices and the software running on processors that control the operation of the data storage devices and the routing of data to and from them. A Compressed Data Library runs under the management of a Library System Control Computer, which controls both the internal operation of the Compressed Data Library and its interaction with other subsystems of the Transmission System.

100. A Compressed Data Library can be a network of mass storage devices connected by a high speed network. The files stored in a Compressed Data Library can be accessed through multiple reception systems, and items are accessed using unique address codes. A Compressed Data

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Library may employ mixed types of media for cost effectiveness in large libraries. In such cases, items stored in the Compressed Data Library can be dynamically moved to the most appropriate media over their lifetimes in the library. For instance, items retrieved more frequently by users would be stored on higher speed, more reliable, and probably more expensive media, while items retrieved less frequently would be stored on more economical, and probably lower performing, less reliable media. Items also could be stored in multiple Compressed Data Libraries when doing so was dictated by the level of their popularity codes; this would allow concurrent distribution from multiple libraries on separate but related Transmission Systems. The movement of content items from one sort of storage medium to another and between libraries for easier access to more popular items could be controlled by the Library System Control Computer, which runs the database management software that controls the location and tracking of the Compressed Data Library.

101. In a Compressed Data Library, all items are stored on line so that they can be readily accessed through the high speed network connections. They can include storage of the program notes input by the system operator. Because of their high speed network connections, multiple communication controllers can access the large quantity of stored data for high speed transfer to user reception systems. Examples are given in the patent specification of the types of devices that could be used for both high popularity and low popularity content items as well as the type of high speed data network that could be used to obtain the objectives of the Compressed Data Library.

102. In consideration of the foregoing with respect to a Compressed Data Library, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**I. Transmission Format Conversion CPU 119**

103. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Transmission Format Conversion CPU are disclosed in the specification of the '992 patent. The

purpose of a Transmission Format Conversion CPU is to retrieve from a Compressed Data Library the data blocks of items to be transferred to a user reception system, to place the data of those data blocks into a format appropriate for delivery over the particular communications channel to be used for each specific transfer, and to pass those data blocks to a Transmitter or to the Library Access Interface, whichever is to be used for delivery to the user reception system. In the process, the Transmission Format Conversion CPU encodes the data, as necessary, for the transmission channel, transferring desired segments of the data from the Compressed Data Library onto the communications channel used to deliver the data to the reception system. The Transmission Format Conversion CPU shares distributed management of the transmission process with the queue management software that runs on the Library System Control Computer, receiving instructions from the queue management process and executing its assigned tasks independently.

104. There were numerous types of formats that could have been used for the data transfers contemplated in the patent at the start of 1991. For example, in two-way applications, there was the File Transfer Protocol (FTP), which had been publicly proposed as early as April, 1971, and was standardized, in essentially its current form, in a document dated June, 1980. FTP might have been used directly for the necessary transfers of data or could have served as an example for a customized protocol for use in the system described in the '992 patent. Other examples of data transfer mechanisms that could have been used directly or as models for custom solutions for two-way connections were well known for use over modems of various sorts in the 1980s. These protocols included Kermit, X-Modem, Y-Modem, Z-Modem, and a host of contemporaries and derivatives of these methods.

105. For one-way communications links, as pointed out in the '992 patent (17:12-18), in place of the data reception confirmation capability of the two-way protocols, it was expected to add redundancy to the data to ensure reliable delivery of the data. Examples of the types of redundancy that could be applied were the Reed-Solomon (RS) codes and the Bose-Chaudhuri-Hocquenghem (BCH) codes, both of which had been documented first in 1959 and had seen numerous analyses and implementations over the years prior to 1991. One widely-distributed use of the RS codes was in the Compact Disc digital audio system, which had been sold to the public in the millions of copies

since 1982. Also available were error correcting codes (ECC) that worked at the modulation level, as opposed to the data level, such as convolutional codes, which had been available since the 1970s. It was well known to apply these techniques together to achieve maximum reliability over unreliable data links. The data level and modulation level coding could be applied in either the Transmission Format Conversion CPU or in the Transmitter, depending upon just where the break was between the two components of the actual transmission process. The same types of basic techniques for forward error correction (FEC), using the addition of redundant data at one or two levels within the data preparation and transmission process, were applicable to all one-way communications channels such as those on cable television systems, satellite transponders, or over-the-air (OTA) broadcast television.

106. In consideration of the foregoing with respect to a Transmission Format Conversion CPU, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**J. Library System Control Computer 1123**

107. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Library System Control Computer are disclosed in the specification of the '992 patent. The purpose of a Library System Control Computer is to receive user selection requests either directly or from Remote Order Processing & Item Database subsystems, to turn those requests into instructions for one or more Transmission Format Conversion CPUs to retrieve the requested information from a Compressed Data Library and to transmit it to a designated reception system, and to provide confirmation of transmission and reception to business applications such as a billing program. In carrying out these functions, the Library System Control Computer runs a distribution/queue manager program to control the distribution of requested items to the reception systems of users. It shares distributed management of the transmission process with one or more Transmission Format

Conversion CPUs, issuing instructions to those computers, which then execute the assigned tasks independently. It also indicates to the appropriate file server or other data repository in a Compressed Data Library the data to be transferred to the transmitter or transmitters in one or more Transmission Format Conversion CPUs.

108. Additional functions that could be performed by a Library System Control Computer include hosting the item database master, keeping it updated and current with the contents of the Compressed Data Library, running an application program that enables user access to the item database master in conjunction with an application program running on the reception system, accepting connections to the item database master over any available telecommunications channel, and selecting individual songs from the Compressed Data Library for transmission to a receiving system. When a Library System Control Computer receives orders from a Remote Order Processing & Item Database subsystem, they come through the Library Access Interface for the library that it controls and include the user account IDs, identification of items for transmission, and chosen destinations for the selected items for each transaction.

109. Many of the functions required of and optional for the Library System Control Computer of the '992 patent were comparable to functions that had been performed in television automation systems for decades by January, 1991. As an example, the systems on which I worked in the 1970s and 1980s, to which I previously referred, had the capability to receive selections from a database that were turned into requests for the transmission of the corresponding content items at specified times. Often, there were additional constraints, such as not placing two automobile commercials side by side or completing the airing of a particular series of advertisements by a certain date. The systems were capable of presenting to a user information about the contents of various libraries in the system, organized alphabetically by the names of programs, by the names of advertisers, or by other characteristics of the material expressed in text; organized by the dates on which the material was produced, the dates on which it first aired, the dates on which it could last air, and similar date-related characteristics; or organized by the number of times it had aired, the category in which it was included, or the type of machine on which it was to be played back.

110. There also were systems for automatically transferring copies of content, e.g., news

stories, from one facility in a network to one or many others, based on the transmission of schedules to all locations on the network and the selection at each network node of those items that were to be recorded locally. While the content items involved in the systems of the 1970s and 1980s were stored on physical media, those media frequently were stored on large, automated, media-handling systems that recorded and played back content under computer control, and the queuing and control issues were very similar to those implicated in the Library System Control Computer of the '992 patent. Given the commercial availability of the various automation systems and the automated content storage systems with which they operated, one of ordinary skill in the art of the '992 patent would have been aware of such systems in January, 1991, and would have been able to use them as models for the sorts of solutions needed in building a system to implement the methods of the '992 patent.

111. In consideration of the foregoing with respect to a Library System Control Computer, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects. This is particularly true since the functions of the Library System Control Computer are essentially based upon software functionality, for which only the inputs, functions, and outputs are necessary to create a presumption of enablement, given the instructions I have received.

**K. Library Access Interface 121**

112. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Library Access Interface are disclosed in the specification of the '992 patent. The purpose of a Library Access Interface is to provide to users access to the information about items stored in the Compressed Data Library as well as to transfer blocks of audio and video data, to receive transmission requests directly from users or indirectly through Remote Order Processing & Item Database subsystems, to enable various sorts of access to items for customers of a system operator,

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and to communicate a list of available titles for alphabetical display in a title window on reception systems. Examples of the types of access that can be provided to users for obtaining information about the offerings on the system and for placing orders for the delivery of content are through use of telephone tone decoders and voice response hardware; through telephone operators who can assist users not only in obtaining information about items available on the system and placing orders but also in signing up for the service, dealing with billing problems, and the like; and through user terminal interfaces, which could include either separate computer terminals (like personal computers) or terminals and/or displays integrated into reception systems.

113. It should be noted that an "interface" can have varying degrees of complexity, depending upon the requirements of a particular system and the exact function to be served. A simple interface might constitute a cable with specific connectors at each end, specified wiring of the connectors, specified signals to be applied to each of the terminals of the connectors, and specified meanings of and relationships between the signals on the terminals. In addition, the interface in the case just described would include the electronics at each end of the cable, perhaps in a personal computer and a printer that were to be connected together. A more complex interface might have a fairly complex process associated with it, for instance, to allow a human to interact with a machine. Such an interface might involve a display to present information from the machine to the human, an input device such as a keyboard or a touch screen to enable the human to provide information to the machine, software processes to arrange the presentation on the screen and to collect and organize the input from the human, and the like. There even could be an intermediary element in which a human spoke by some communications means to another human who was trained on the subject system and actually operated the interface functionality.

114. There were examples of user access and ordering systems similar to those described in the '992 patent going back at least to the 1970s and 1980s. For instance, there had been Automatic Number Identification (ANI) and Automatic Voice Response (AVR) equipment in use in the cable television industry and elsewhere. The Automatic Number Identification system was dependent on Caller ID data, the Caller ID system having been developed in the late 1970s through the mid-1980s. Similarly, there had been developments during that same period of terminals that

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consumers could have in their homes for conducting interactive transactions with centralized computer systems. Many such systems were based on a technology known as videotex, which was developed in the late 1970s and tested in the marketplace in the early 1980s. Probably the most successful videotext system was the Minitel system installed in France in the 1980s to replace paper telephone books. Minitel also enabled a range of commercial functionality, such as the placing of orders for products and services over the system, in addition to looking up telephone numbers. Another system related to videotex was teletext, which was a one-way system for delivering paragraphs of text and simple graphics for presentation on television-like displays. I had personal experience with these systems, conducting tests of teletext transmission using the French Telidon system in the 1982 time frame at KPIX in San Francisco.

115. In consideration of the foregoing with respect to a Library Access Interface, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

## XII. RECEPTION SYSTEM

116. The purpose of reception systems, fundamentally, is to reverse the processes of transmission systems and to deliver on their outputs the signals or content that were put into the transmission systems to which they are connected. As a general rule, the reception processes are placed in reverse order to the processes in the transmission system so that processes last applied are the first to be reversed. Another way to look at this is that those processes closest to the transmission or transfer medium used to carry the signals from the transmitting side to the receiving side correspond to one another. The overall system then is built up from layers that extend out from the transmission medium in the center. With respect to the transmission and reception process itself, the coding closest to the medium would be described as "inner" coding; coding at a layer further from the medium would be described as "outer" coding. Taken together, these transmission and

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reception processes generally are known as "channel coding" and "channel decoding." Beyond the channel coding and decoding processes, as seen from the medium, are processes known as "source coding" and "source decoding," which comprise techniques that generally are independent of the transmission methods used. Digital audio and video compression and decompression, for example, constitute source coding and source decoding methods

117. With this context, it now is possible to examine the processes described for the Reception System of the '992 patent in relation to their corresponding processes in the Transmission System already evaluated above. It is important to recognize that the various techniques employed for coding and decoding of a particular layer within an overall system normally are developed together, since neither of them is useful on its own. Thus, their historical antecedents will be shared and, in this case, will be the same for the Reception System of the '992 patent as for its Transmission System.

**A. Receiver Format Converter 202**

118. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Receiver Format Converter are disclosed in the specification of the '992 patent. The purpose of the Receiver Format Converter is to receive the data from the Transceiver and convert it into a format that can be stored in the Storage subsystem and that can be passed to the subsystems that further decode the signals received from the Transmission System. Looking at the steps needed to reverse the processes that take place in the Transmission System, the Transceiver, which is in the Reception System processing chain just prior to the Receiver Format Converter, effectively reverses what takes place in the Transmitter block of the Transmission System. The Receiver Format Converter then essentially reverses what took place in the Transmission Format Conversion CPU. Between the Transceiver and the Receiver Format Converter, if the transmission medium, for example, was one that required the addition of redundant information, they would have removed the redundant data and corrected the transferred data by the time that data emerged from the output of the Receiver Format Converter. Similarly, if there were no redundant data required by the transmission medium, there still likely would have been transmission protocol elements to be stripped away in order to expose the underlying data to be stored and eventually decoded.

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119. A person of ordinary skill in the art of the patent, in January, 1991, would have understood the concept of reversing in a receiver the processes that were applied to data in a transmitter connected through a medium to that receiver. Thus, that person would have understood the Receiver Format Converter to have been for the purpose of reversing the processes of the Transmission Format Conversion CPU, whatever those processes might have been that were appropriate for the medium used to connect the Transmission System to the Reception System.

120. In consideration of the foregoing with respect to a Receiver Format Converter, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Reception System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**B. Storage 203**

121. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Storage subsystem are disclosed in the specification of the '992 patent. The purpose of the Storage subsystem is to enable buffering of requested material for later viewing; to enable a combination of buffering and non-buffering operation; to enable temporary storage of audio and video material for listening and/or viewing by users at times of their choosing subsequent to the delivery of the data representing the material; and to store the compressed, formatted data blocks representing audio and video, for playback of the items they represent by a user at a time later than originally requested, when desirable.

122. In its position within the Reception System relative to location surrounding the transmission medium, the Storage subsystem corresponds to the Compressed Data Library in the Transmission System, but it does not really reverse any processing done by the Compressed Data Library. Instead, it complements the functionality of the Compressed Data Library by providing for distributed storage of content. This permits the staging of content where it will be needed at times that are convenient for system operation – allowing transmission during times of low traffic on the

transmission medium, for example, and permitting use of slower transmission media than would be possible if the content had to be transmitted just at the time it was to be consumed (listened to or viewed). Just as with the Compressed Data Library, the inputs to and outputs from the Storage subsystem are identical with one another; i.e., there is no processing – only time delay.

123. Inherent in the Storage functions enumerated in the '992 patent is an embedded controller to manage the Reception system in response to transmissions received from a Transmission System and user inputs. Such an embedded controller is necessary because storage devices (e.g., hard drives) and memory devices do not work on their own; they require controllers to cause them to store information in and retrieve information from specific places within their available storage spaces and to create indices of the places where information has been stored so that it can be recalled later. Such an embedded controller, at the start of 1991, was likely to be a microprocessor along with its attendant memory and other peripheral devices. The controller would be necessary to determine where, on the storage medium used, each group of data blocks representing an item (probably in the form of a file) was to be placed when it was received from the Transmission System. Then, it would be necessary for the controller to store, locally in memory or on the storage medium, the locations of the content items it had placed onto the storage medium so that those items could be recalled from the storage medium when requested by a user. The controller further is needed to enable the function described in the '992 patent in which a user can request a song by its identifier and have it sent from the Transmission System or played back locally if it already is buffered on the Reception System. Yet a further function of the embedded controller is supporting the playback controls described in the '992 patent to permit the choice of play, play slow, pause, stop, fast forward, and rewind functions, which would involve controlling the Storage subsystem and, depending on design choices, such capabilities as remote control operation of the playback controls.

124. Controllers of the sort described were well known by the start of 1991. They were used in places like cable television set top boxes and in all sorts of industrial applications. For example, in set top boxes, embedded controllers performed functions such as tuning the set top box receivers to channels desired by users, indicating the channel tuned, providing integration of

wireless remote controls, controlling the audio volume, managing the insertion of closed captions, and the like. For another example, in 1978 and 1979, I designed a microcomputer-based machine control system for KPIX that subsequently became the foundation for an industry standard. That system had 107 standalone controllers with embedded microprocessors connected together in a network that permitted distributed control of machines located throughout the technical areas of the television station. Included were interfaces from the embedded processors to control panels that were used by operators to communicate instructions to the system and to various sorts of machine interfaces that were used to convert the operators' instructions to actions by the connected machines.

125. In the Reception System of the '992 patent, the inherent embedded controller would control the Storage subsystem, support the playback control functions, support the User/Computer Interface, and carry out all the other housekeeping necessary to manage a complex consumer device. A person of ordinary skill in the art in January, 1991, would have understood the inherent inclusion of such a processor and would have known how to build and use one without undue experimentation, based on the sorts of well known implementations in existence at that time, examples of which are given above.

126. In consideration of the foregoing with respect to a Storage subsystem, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Reception System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**C. Data Formatter 204**

127. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Data Formatter are disclosed in the specification of the '992 patent. The purpose of the Data Formatter is to receive compressed formatted data blocks from the Storage subsystem when playback is requested, to process the data blocks to separate the audio and video data from one another, and to pass the separated audio and video data to their respective decoders. The Data Formatter effectively

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reverses what took place in the Compressed Data Formatter of the Transmission System. Implicit in the ability of the Data Formatter to separate the audio and video data from one another is either a known data structure within the stored or played out data, in which the audio and video data are placed in a predetermined arrangement that can be depended upon by the process of the Data Formatter, or the use of identifiers within the data to separately identify audio data and video data so that the Data Formatter can determine which is which. A person of ordinary skill in the art of the patent, in January, 1991, would have understood the concepts of reversing in a receiver the processes that were applied to data in a transmitter connected through a medium to that receiver and of matching the processes, layer by layer, as those layers surrounded the medium on the transmitting and receiving sides of the overall system. Thus, that person would have understood the Data Formatter to have been for the purpose of reversing the processes of the Compressed Data Formatter.

128. In consideration of the foregoing with respect to a Data Formatter, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Reception System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**D. Decompressors 208 & 209**

129. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Video Decompressor and of the Audio Decompressor are disclosed in the specification of the '992 patent. The purpose of the each decompressor is to receive appropriate compressed data from the Data Formatter, to decompress the video data to baseband video and the audio data to baseband audio, respectively, and to pass the decompressed baseband video and baseband audio to their respective Output Converters. The Video and Audio Decompressors effectively reverse what took place in the Video Compressor and the Audio Compressor of the Transmission System. A person of ordinary skill in the art of the patent, in January, 1991, would have understood the concepts of reversing in a

receiver the processes that were applied to data in a transmitter connected through a medium to that receiver and of matching the processes, layer by layer, as those layers surrounded the medium on the transmitting and receiving sides of the overall system. Thus, that person would have understood each of the Decompressors to have been for the purpose of reversing the processes of the corresponding Compressor.

130. In consideration of the foregoing with respect to the Decompressors, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Reception System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**E. Output Converters 206**

131. As shown in the table of Exhibit B, the inputs, functions, and outputs of the Output Converters are disclosed in the specification of the '992 patent. The purpose of the Output Converters is to receive decompressed baseband signals from the Decompressors and to produce real time digital video (211), digital audio (212), analog video (213), and analog audio (214) for output to other systems connected to the Reception System. The Output Converters effectively reverse what took place in the Converter of the Transmission System. The Output Converters also are where any copy protection is applied to the digital and analog video outputs, according to whether the requirement for copy protection of each specific content item is signaled by the information that was stored in the Item Database during the Storage Encoding process. It should be noted that, while not technically one of the Output Converters, the Compressed Data Port similarly will not pass an item when copy protection is asserted for that item.

132. The Output Converters essentially provide signals to output interfaces from the Reception System to other devices outside the overall system. The outputs provided all are conventional signal types either that long had been in use for consumer applications by January, 1991, or that had been in use for professional applications and easily could be adapted for consumer

use. The analog outputs both fall into the category of having had long application to consumer interfaces before 1991. The digital audio interface had been in use for consumer interfaces before 1991 and was well documented, although it was newer and less frequently used. The digital video interface would have required adaptation of a professional interface, but they, too, were well documented and widely applied in 1991, if somewhat expensive because of their limited use to that point. Certainly, a person of ordinary skill in the art at the start of 1991 would have been aware of all of these interfaces and would have been able to put them to use in the Reception System output application.

133. In consideration of the foregoing with respect to the Output Converters, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Reception System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**F. User/Computer Interface 207**

134. As shown in the table of Exhibit B, the inputs, functions, and outputs of the User/Computer Interface are disclosed in the specification of the '992 patent. The purpose of the User/Computer Interface is to serve as an ordering method to provide customer access to stored items; to provide a mechanism for displaying to users lists of available titles that can be obtained through the system, including such lists presented at least alphabetically; to provide a window having two modes – one listing the material contained locally, in the Transmission System to which the Reception System is connected, and one listing the titles of material that may be received from remotely accessible libraries; and to provide a window in which the listed titles are sent either from a database on a Library System Control Computer or one on a Remote Order Processing & Item Database. The User/Computer Interface effectively serves as a terminal in the Reception System for interaction between a user and the system.

135. Interfaces of the sort described were in wide use on consumer products in the late

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1980s. They typically included a small alphanumeric display and some controls on the front panel of the device in which they were included. They were operated by the microcontroller that controlled the operation of the remainder of the consumer product of which they were part. Typically, they were for the purpose of operating the device of which they were part, but sometimes those devices were linked to other consumer products for joint or remote control. The operation of the interfaces, once the display and input hardware was included in the product and connected to the internal controller, depended fully on software to define the functions of the input buttons and keys and to define the information to be displayed and its layout. A person of ordinary skill in the art of the '992 patent, at the start of 1991, would have known about the sort of interfaces described and would have understood how to design and program them.

136. In consideration of the foregoing with respect to a User/Computer Interface, it is evident that the inventors disclosed sufficient information about such subsystems that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Reception System in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such subsystems that they could have been built and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system design that were normal for the development of such technological objects.

**G. Reception Confirmation Function**

137. The Reception Confirmation Function is not explicitly described in the table of Exhibit B, but it is described in the context of the listing for the Queue Manager Program in the table. The operation of the Reception Confirmation Function is described in the text of the '992 patent specification and in the flowchart of Figure 5 of the patent. Its purpose is to confirm that the Reception System to which an item of information is to be delivered actually receives the item – both to improve the reliability of delivery and to assure that delivery has occurred prior to billing the customer for the item. In the case of a two-way data delivery channel from the Transmission System to the Reception System, the Reception System confirms to the Communications Controller its reception of the initial data block before the remaining data blocks are sent. Once a complete item is received, that fact is communicated as well. When a one-way data delivery channel is

involved, reception is confirmed by the Queue Manager Program through a telephone connection to the Reception System, for example, prior to updating the user's account and the dispatch lists.

138. Reception confirmation for flow control and other purposes were well known techniques throughout the 1970s and 1980s. They had been standardized in such methods as the Transmission Control Protocol and the File Transfer Protocol, which are among the suite of Internet Protocols that were developed initially in the early 1970s. These methods, including the Reception Confirmation Function, consisted of interactions between software structures at the two ends of a communications channel. In the case of the '992 patent, software to support the Reception Confirmation Function is required in the Queue Manager Program and in the Communications Controller of the Transmission System and in the Reception System, likely running on the embedded controller in that portion of the overall system. A person of ordinary skill in the art of the patent, at the beginning of 1991, would have been aware of the techniques for reception confirmation and would have had the software writing capability to create an interaction between the Reception System and the Transmission System of the sort described in the '992 patent simply by defining the interaction and then writing the necessary software code.

139. In consideration of the foregoing with respect to the Reception Confirmation Function, it is evident that the inventors disclosed sufficient information about such software interactions that one of ordinary skill in the art of the patent would have recognized that they were in possession of that portion of the Transmission and Reception Systems in January, 1991. They also provided sufficient information about the inputs, functions, and outputs of such software systems that they could have been written and used by one of ordinary skill in the art, in early 1991, without undue experimentation, by applying the processes of system and software design that were normal for the development of such functions. This is particularly true since the Reception Confirmation Function is essentially software functionality, for which only the inputs, functions, and outputs are necessary to create a presumption of enablement, given the instructions I have received.

## XIII. ADDITIONAL QUESTIONS

140. As noted previously, I have been asked to address a group of twelve supplemental questions. The questions are presented below in italics. Some questions are in two parts. The

questions are identified by numbers in the headings of the subsections below.

### A. Additional Question 1

*Would the disclosure of the '992 patent application reasonably have conveyed to one of ordinary skill in the art in January 1991 that the inventors were in possession of a method of transmitting information without first receiving a user request?*

141. While the preponderance of information in the patent points to users making requests for content to be transmitted to their receiving systems, there is at least one indicator that the inventors included a method that did not require a request in advance of transmitting content, at any rate in some applications. That indicator is contained in the first original claim. In that claim, there not only is no requirement for there being a request prior to transmitting content, there is no means or method provided for such a request to be made.

142. A person of ordinary skill in the art, examining the patent and original claim 1 in January 1991, would have found there to be a description of a transmission system for providing information to remote locations comprising means for library storage of items, identification encoding of those items, conversion of those items into a predetermined format, ordering the formatted data into a sequence, compressing the formatted and sequenced data, storing the compressed data, and transmitting the compressed data to a remote location. There is no provision in any of these constituent means of the transmission system for the acceptance of requests from users. Indeed, it is not until original dependent claim 7 that a library access interface means is introduced, along with the concept of receiving transmission requests, although whether those requests come from users or from system operators is unspecified in that particular claim.

143. Since a system control interface and the library access interface that are necessary to support the reception of transmission requests by the transmission system are the only elements introduced by original claim 7, they must not exist in original claim 1. Thus, original claim 1 clearly would have been understood by the person of ordinary skill in the art of the patent in January 1991 as not including the means to accept requests for the transmission of content to remote locations. Consequently, the inventors would have been understood as having a method for transmitting information without first receiving a user request.

**B. Additional Question 2**

*Would the disclosure of the '992 patent application reasonably have conveyed to one of ordinary skill in the art in January 1991 that the inventors were in possession of a method of transmitting information to one of a plurality of "remote locations" (as opposed to transmission to a receiving system)?*

144. There are, in the '992 patent, numerous references to transmission to "remote locations," as opposed to transmission to a receiving system. Such references occur both in the specification and in the original claims. There also are places in the specification that describe transmission to a "delivery location" or to "the location of playback." For example, Figure 7 includes blocks labeled "send to remote location" (416) and "receive at remote location" (417), and original claims 1 and 18 describe "a transmission system for providing information to remote locations" and "a distribution method responsive to requests identifying information to be sent from a transmission system to remote locations," respectively. Similarly, the specification describes a "delivery location" (14:33), "the location of playback" (14:45), and "transmission [to] a specific … location" (15:21-22).

145. There also is included in the specification of the '992 patent description of transmission of the desired information by satellite and by "airwave" broadcast signals. When these transmission methods were employed, the signals carrying the information would be dispersed to many locations within the ranges of the particular transmitters used. Clearly, essentially all of the locations to which the transmitted signals would be propagated would be remote from the location of the transmission system. Hence, it would be apparent that the information was being transmitted simultaneously to a multitude of remote locations. Moreover, the technique of assigning unique addresses to receiving systems, so that they could be controlled in a variety of ways such as triggering the reception of particular information, was well known in a variety of industries prior to January 1991. Thus, a reception system could have been placed at any of the remote locations and the transmission system set up to deliver content only to that reception system, since addressing of the user or the reception system was described in the patent (e.g., 12:24-27). Thus, the information could be transmitted to one of the plurality of remote locations receiving the signals.

146. Given the usages within the specification and the original claims, as well as the understanding that a person of ordinary skill in the art in 1991 would have had with respect to the regions that would be reached by signals from the sorts of transmitters identified in the specification and the methods for selecting receiving systems to receive data, it is clear that the disclosures of the specification and original claims would have conveyed to such a person that the inventors were in possession of a method for transmitting information to one of a plurality of "remote locations."

**C. Additional Question 3**

*1) Would the disclosure of the '992 patent application reasonably have conveyed to one of ordinary skill in the art in January 1991 that the inventors were in possession of a method for assigning a unique identification code to a physical item having information?*

147. As described in the specification of the '992 patent, physical items are stored temporarily in a Source Material Library prior to the conversion of their content to the native format used within a Transmission System and the compression of that content for long term storage in a Compressed Data Library. As described in the specification (e.g., 6:15-19), the contents of the Source Material Library are converted to or recorded on a media format compatible to the digital and analog inputs of the system prior to their being compressed and placed into long-term storage. The media formats described for temporary storage in the Source Material Library include digital or analog audio and video tapes, several forms of optical or magnetic disks, and divers computer media. Inherent in the description in the specification is that such media would be stored in the Source Material Library in appropriate facilities for the type of media used and that the data from them would be recovered using compatible machinery as the information they contained was retrieved into the processes that were connected to the output of the Source Material Library. This is exemplified by the description of the use of a telecine to retrieve the information from motion picture film (7:35-39).

148. In devising the necessary storage facilities for the media type(s) used and in retrieving the content from that media, a person of ordinary skill in the art of the '992 patent implementing the Source Material Library would apply the latest available equipment and methods to the process. In early 1991, that would have included the use of automated playback machinery

for video and audio tapes stored in cartridges or cassettes, for laserdiscs, for compact disks, and the like. For other types of media such as motion picture film, it would have included telecines or film chains that depended on an operator to load and thread ("lace") the film onto the projection portion of the system and to similarly load other sorts of devices for other types of media.

149. For much of the 50-year history of the television industry by January 1991, a variety of media were used to provide content for inclusion in the programs or to distribute the programs that were broadcast to the public. Those media were identified by unique identifiers assigned within the operations using them, typically called "house numbers" and having a scope of uniqueness at least across the media maintained by individual television stations. The normal practice in television operations was to physically label the media with the house numbers and other descriptive information, such as, for example, series title and episode number and title. In the early days, this was done by taping a label to the shipping or storage container in which the media was stored. Later, the use of pressure sensitive labels became prevalent, with the same type of information recorded on the label for each medium.

150. During the 1980s, bar codes came into use to support the operation of automation systems. Bar codes enabled automated reading of the identifiers of media as that media was inserted into and removed from recording and playback equipment. When tied to the databases that were part of the automation systems, the bar code identifiers and the procedures for using them permitted complete knowledge of the locations and contents of media throughout a facility, as well as knowledge of any information associated with the media or its contents.. Eventually, the use of bar codes was internalized within the machinery itself. For example, in about 1989, a device manufactured by Sony, called the Betacart, included a bar code label printer and bar code readers to enable its internal control system to know the locations of all of the tape cartridges stored in its many bins and inserted into its several tape decks.

151. The use of labels and, in particular, bar code labels was well known in the television industry, by January 1991, and would have been common knowledge to one of ordinary skill in the art of the '992 patent at that time. Since it is not required that techniques well known in the industry to which a patent applies be included in the specification of a patent, it would have been inherently

known to persons of ordinary skill in the art of the '992 patent in January 1991 that the inventors were in possession of a method for assigning unique identification codes to physical items having information.

*2) Could one of ordinary skill in the art, using his knowledge and the disclosure of the '992 patent, in January 1991, have made and used a method for assigning unique identification codes to physical items having information without undue experimentation?*

152. As described in the earlier part of this report dealing with the Transmission System, the assignment of unique identification codes to objects – whether physical objects or "information objects" – was well known in the art, well before the time of filing of the '992 patent application. Similarly, as just described above in answer to the first part of this question, the methods for labeling physical objects with unique identification codes assigned to them also was well known in the industry, along with the methods for generating and reading the bar code labels that carried the identifiers and bound them to the objects they identified. Such systems were commercially available in the marketplace. Thus, it is clear that one of ordinary skill in the art, using his or her knowledge and the disclosure of the '992 patent, in January 1991, could have made and used a method for assigning unique identification codes to physical items having information without undue experimentation.

### D. Additional Question 4

*1) Would the disclosure of the '992 patent application reasonably have conveyed to one of ordinary skill in the art in January 1991 that the inventors were in possession of a local distribution system?*

153. In the specification of the '992 patent, the inventors describe several overall system configurations in which there are Reception Systems at remote locations and there is further distribution from the remote locations to the locations where end users can consume (view or listen to) the distributed content. Examples of such configurations are contained in Figures 1d, 1e, and 1f, all of which are described as having the Reception Systems incorporated into cable television systems, presumably at their headends, although only the description of Figure 1f says so explicitly (4:44-46). The specification describes various ways in which the secondary distribution can take

place from the cable headends to the user (cable subscriber) locations.

154. Taken generically, Figures 1d, 1e, and 1f describe remotely located Reception Systems that feed their outputs into redistribution systems that, in turn, deliver the content of items to reception devices (television receivers, videotape recorders, and the like) at locations further from the Transmission System than is the Reception System. In the generic case, delivery from a Transmission System to a Reception System could be over any form of data communication channel available, and similarly redistribution from the Reception System to reception devices could be over any appropriate form of communications channel. Thus, as noted in the specification these channels could include standard telephone, ISDN or B-ISDN, microwave, DBS, cable television systems, Metropolitan Area Networks (MANs), or anything else that might be available.

155. In the configurations cited, it would have been clear to a person of ordinary skill in the art of the '992 patent, in January 1991, that the Reception Systems were at locations remote from the Transmission System and could be part of a redistribution function. It similarly would have been clear to such a person that the redistribution of the content from the Reception Systems to end users (subscribers) was local to the redistribution systems in juxtaposition to the remote locations of the redistribution systems relative to the Transmission System.

156. Given that the inventors described methods for redistribution of the content received at the Reception Systems to the subscribers of the systems of which those Reception Systems were part, it would have been apparent to a person of ordinary skill in the art of the '992 patent, in January 1991, that the inventors were in possession of a local distribution system.

*2) Could one of ordinary skill in the art, using his knowledge and the disclosure of the '992 patent, in January 1991, have made and used a local distribution system without undue experimentation?*

157. As of January 1991, the technology for distribution of television signals over cable television systems was well known and commercially available. The use of cable television channel converters (set top boxes) also was well known at that time, and they were widely applied. There was not yet commercial deployment of digital distribution of television signals over cable systems, but the necessary equipment was in development. The fundamental digital compression methods

that enabled the use of digital techniques on cable systems had already been developed and published, as described in the patent specification and previously in this report.

158. In light of these circumstances, in January 1991, a person of ordinary skill in the art of the '992 patent could have employed commercially-available analog equipment for both the network distribution and consumer premises equipment (CPE) functions to build a local distribution system. The person of ordinary skill in the art also could have employed digital compression methods in the local distribution system with little more development effort than already described above with respect to application of digital compression to the Transmission System. The development effort for use of digital techniques in the local distribution system would have involved placing at the cable headends storage for the digital data retrieved by the Reception System located there, reapplying the same compression techniques used in the Transmission System, and then applying in the CPE the methods described in the patent for the reception system. Because of the commercial use of analog cable distribution and CPE and the widespread knowledge of the fundamental technology of digital compression, a person of ordinary skill in the art in January 1991 could have build and used a local distribution system without undue experimentation.

**E. Additional Question 5**

*1) Would the disclosure of the '992 patent application reasonably have conveyed to one of ordinary skill in the art in January 1991 that the inventors were in possession of the step of generating a listing of available items?*

159. The specification of the '992 patent describes the use of database systems for managing the content of the various libraries in the Transmission System and for providing information to end users for placing of requests for the delivery of content. The master copy of the database that listed the items available through the system was described in association with the System Control Computer. (11:54-57) Other copies were described as being maintained on the Remote Order Processing and Item Database computers. (11:66-12:4) A variety of functions were ascribed to the database systems, including the ability to enable key word searches by users (The example given was "Tibetan Medicine," located by searching on "Tibet" and "Medicine." [12:12-21]) and to provide alphabetized lists of available titles for presentation in a window on Reception

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Systems.

160. Database management systems had been available as commercial software applications for many years by January 1991. One of the earliest available for personal computer use was the dBase program from Ashton Tate. It was a relational database. There also were many so-called "flat file" database programs commercially available by the beginning of 1991. The purpose of database applications is to store large volumes of data and to present that data sorted in a variety of useful ways – often involving complex relationships between various aspects ("fields") of the data items ("records") stored. A listing is one form of presentation of data.

161. Given that databases were well known in January 1991 and were widely understood to be capable of producing all sorts of listings of the data they contain and given that the specification of the '992 patent includes numerous references to and descriptions of the use of databases – both for system management and for presentation of data to end users – it is clear that the disclosure of the '992 patent application reasonably would have conveyed to one of ordinary skill in the art in January 1991 that the inventors were in possession of the step of generating a listing of available items.

*2) Could one of ordinary skill in the art, using his knowledge and the disclosure of the '992 patent, in January 1991, have made and used the step of generating a listing of available items without undue experimentation?*

162. With the ready availability of database management software, the use of such software for the management and control of the systems described in the patent specification, and the skill set and knowledge ascribed previously to one of ordinary skill in the art of the '992 patent in January 1991, such a person could have made and used the step of generating a listing of available items without undue experimentation, indeed, without any experimentation but only conventional system and software design.

**F. Additional Question 6**

*1) Would the disclosure of the '992 patent application reasonably have conveyed to one of ordinary skill in the art in January 1991 that the inventors were in possession of subscriber-selectable receiving stations?*

163. As demonstrated in Figures 1d, 1e, 1f, and the specification text that describes them, there are two primary ways in which the contents of items of information can be delivered for presentation to users. They can be sent to Reception Systems to which the display devices (television sets) or the recording devices (videotape recorders) of users are directly connected, or they can be sent to Reception Systems that redistribute the contents of items to users through local distribution systems such as cable television or direct broadcast satellite (DBS) systems. Since the term "receiving stations" is not used in the specification of the '992 patent, it could be argued that the term could cover either of these approaches, with a receiving station being either the combination of a Reception System and a display and/or recorder or a Reception System, a redistribution system (as described in the answer to Additional Question 4 above), and a display and/or recorder. By analyzing both arrangements and showing that the inventors were in possession of receiving stations using both approaches, it will be certain that the inventors were in possession of them, in whatever way the term might be interpreted. Once having established that they were in possession of receiving stations, then the ability of subscribers to select receiving stations can be demonstrated for both potential forms of receiving stations to show that the inventors were in possession of the entire concept.

164. In Figure 1f, two types of connections to "Users" are shown. At the top of the figure, a direct connection between a Reception System and a block labeled User is shown. This is described in the text as a direct-connection situation. (4:34-36) Of course, the output of the Reception System is not plugged directly into a user but rather is made accessible to the user by displaying the content on a video display such as a television set or by recording the content on a device such as a videotape recorder. Similarly, in Figure 1f near the bottom, there are two outputs from the Reception System going to two groups of users. These are described in the text as being feeds to and through a pair of cable television systems. In this case, the Reception System provides redistribution, and the content is delivered to user locations for display on television sets or for recording on videotape recorders or similar devices. The redistribution method is described in the text as being for users who only have cable television decoders and standard television receivers. Whether a "receiving station" is considered to be a Reception System alone, the combination of a

Reception System with a display and/or recorder, the combination of a cable set top box or equivalent with a display and/or recorder, or the combination of a Reception System with a redistribution system, a set top box or equivalent, and a television receiver and/or videotape recorder, the inventors described them all and therefore were in possession of them all.

165. In at least five places within its specification (1:67-2:4; 12:24-27; 14:39-45; 14:59-61; and 15:27-29), the '992 patent application describes the user choosing a delivery location, the system processing the address of the user, the user entering and confirming the playback location or destination, and elements of the system communicating the chosen destination for an item. To enable these activities and functions, receiving stations have to be selectable in one of two ways: If the receiving station involves a direct connection between a Reception System and a display or recorder, it must be possible to set up a one-to-one communications path between the Transmission System and the particular Reception System, or, if the communications path is shared by many users, the Reception Systems must be addressable in such a way that they only will receive content that is addressed to them. On the other hand, if the receiving station involves a connection to a Reception System through a redistribution system, then the redistribution system must provide for addressability of the converter units or equivalent network access devices so that the content of particular items can be delivered only to the subscribers who ordered them. The addressability both of Reception Systems and of receiving stations following a redistribution process depend upon the same techniques.

166. Both of these methods – one-to-one communications and addressability of devices sharing a communications channel – were well known at the start of 1991. The first method, in fact, in one approach, is described in the specification as the Communications Controller in the Transmission System dialing the Receiving Device of the user and the Reception System answering the incoming call and confirming the connection. (16:41-44) The second method, which would pertain both to Reception Systems that were connected to some sort of shared media or channel and to redistribution through shared-channel communications methods such as satellite, cable, or broadcast links, would require that the Reception Systems or network terminals (such as cable set top converters) contain unique addresses and that the Transmission System identify content intended

for specific Reception Systems or network terminals. Such addressability can be obtained through a method known as "conditional access," which had been widely applied in commercial satellite applications by companies such as Linkabit (later part of General Instrument) and Digital Video Systems (later part of Scientific Atlanta) in the mid-1980s. By 1991, the methodology of conditional access was well and widely known.

167. For the redistribution method to function, there needs to be a transfer of information from the Transmission System to a subscriber management system associated with the conditional access system on the output of the Reception System, so that the subscriber management system can direct specific content from the Reception System to a specific subscriber. The need for such information transfers is inherent in the configurations of the systems presented in Figures 1d, 1e, and 1f, and the text describing them in the specification of the '992 patent. The information transfer process would be part of the software processes necessary to operate the overall transmission and reception system and would have been apparent to one of ordinary skill in the art at the beginning of January 1991.

168. Given that the specification of the '992 patent describes delivery of content to user-specified playback locations and that the necessary systems and methods for achieving such delivery include selectable and/or addressable Reception Systems and/or addressable network terminals, and given that the methods for obtaining such selectability and/or addressability would have been known to and understood by a person of ordinary skill in the art of the '992 patent in early January 1991, the disclosure of the '992 patent application reasonably would have conveyed to such a person that the inventors were in possession of subscriber-selectable receiving stations.

*2) Could one of ordinary skill in the art, using his knowledge and the disclosure of the '992 patent, in January 1991, have made and used subscriber-selectable receiving stations without undue experimentation?*

169. Since all of the necessary techniques for delivering content to specified Reception Systems, and from them either directly to displays and/or recorders or indirectly through redistribution methods to displays and/or recorders, were either described in the specification or were well known in the industry, and since the implementation of user-selectability of receiving

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stations would have depended solely on the development of the necessary software, it is apparent that one of ordinary skill in the art of the '992 patent, using his or her knowledge and the disclosure of the patent application, in January 1991, could have made and used subscriber-selectable receiving stations without undue experimentation.

### G. Additional Question 7

*When reading the highlighted portion of claim 17 of the '863 patent that says, "using the stored compressed, digitized data to transmit a representation of the at least one item* ***to at*** *a plurality of subscriber receiving stations coupled to the local distribution system," in light of the specification, would one of ordinary skill in the art in January 1991 have understood this portion of the phrase, and, if so, what would he or she have understood this portion of the phrase to mean?*

170. The specification of the '992 patent is replete with small mistakes in sentence structure, grammar, numerical references, and the like. Sometimes there are incomplete sentences. In some places, words are juxtaposed with one another that do not belong together, as though one of them might have been part of an alternate wording from an earlier draft that should have been but was not removed along with the earlier language. In yet other cases, there are incorrect reference numbers from some of the figures applied following the descriptive names of the elements being referenced. These errors, however, do not make the specification indecipherable.

171. The problem with the wording cited from claim 17 of the '863 patent is of the type that appears to retain wording from an earlier draft, part of which should have been removed when the language was edited. The exact same pair of words, "to" and "at," are used together in one place in the specification of the '992 patent application (which is identical to that of the '863 patent), and their usage is instructive. The specification says, "The transmission system 100 of the present invention preferably further includes transmitter means 122, coupled to the compressed data library 118, for sending at least a portion of a specific file **to at** least one remote location." (emphasis added) In a similar way, claim 17 of the '863 patent, in an earlier draft, might have been written as, "using the stored compressed, digitized data to transmit a representation of the at least one item **to at** least one subscriber receiving station coupled to the local distribution system." Recognizing that this is speculative, if this had been the case, when changing the language from "to at least one

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subscriber receiving station," to "to a plurality of subscriber receiving stations," the word "at" should have been removed and seemingly was not.

172. In any event, when reading the portion of claim 17 of the '863 patent highlighted in the question in light of the specification, one of ordinary skill in the art of the patent, in January 1991, would have understood the phrase and would have taken it to mean, "using the stored compressed, digitized data to transmit a representation of the at least one item to a plurality of subscriber receiving stations coupled to the local distribution system." This means that a copy of the stored compressed, digitized data representing an item of information was to be sent to multiple subscriber receiving stations through a local distribution system. Doing so is fully described in several places in the specification, when they are taken together. (4:52-57; 15:47-54; and 15:61-64)

### H. Additional Question 8

*When reading the phrase "storing items having information in a source material library" from claim 41 of the '992 patent, in light of the specification, what would one of ordinary skill in the art in January 1991 have understood with respect to when this step must finish?*

173. There are two libraries described as part of a Transmission System in the specification of the '992 patent. These are the Source Material Library and the Compressed Data Library. Storage in the Source Material Library is described as being temporary in nature. (5:66-6:2) It is for the purpose of retaining the items to be made available through the Transmission System prior to their conversion to the native format of the system, their compression, and their storage in a Compressed Data Library. The Compressed Data Library, on the other hand, is where the items are stored long term, so that they can be delivered to users at any time following the conversion and compression processes, without those processes having to be repeated prior to each delivery. The long term nature of the storage in the Compressed Data Library is underscored by the fact that it is the items retained in the Compressed Data Library that are included in the database of available items and listed so that users can search for them through the various means described in the specification. (See, e.g., 11:54-57.)

174. Given this relationship between storage subsystems in the Transmission System, once the data representing an item had been retrieved from the Source Material Library, processed, and

stored in the Compressed Data Library, there would be no further need in the Source Material Library for the source material from which the data representing the item was retrieved. Consequently, one of ordinary skill in the art of the '992 patent, in January 1991, when reading the phrase "storing items having information in a source material library" from claim 41 of the patent, would have understood that step to finish when the process of retrieving the data representing the item had been completed, as there would be no further need for the source material.

### I. Additional Question 9

*When reading the step of claim 45 of the '992 patent that says, "separately storing a plurality of files, each including compressed, sequenced data blocks," in light of the specification, would one of ordinary skill in the art in January 1991 have understood this phrase, and, if so, what would he or she have understood this phrase to mean?*

175. Claim 45 depends from independent claim 41 of the '992 patent. Both are method claims, with claim 41, read in light of the specification, including the steps of storing items in a Source Material Library; retrieving the information in the items; assigning a unique identification code to the information for each of the items; placing the information into a predetermined format; placing the formatted data for each item into a sequence of addressable data blocks; compressing the formatted and sequenced data blocks; storing the compressed, formatted, and sequenced data blocks for each item in its own file, associated with its assigned unique identifier; and sending at least a portion of the file containing data for an item to one of a plurality of remote locations.

176. Claim 45 includes the step of "separately storing a plurality of files, each including compressed, sequenced data blocks." This language is parallel to the language of the second storing step in claim 41 and therefore supplements it. In addition to just storing the compressed, sequenced data blocks for the files processed in a Transmission System, as in claim 41, other files are to be separately stored in that Transmission System – files that presumably came through another processing path such as through an inter-library transfer from a different Transmission System where the items they contain were processed. There is a small difference in the descriptions of the data blocks to be stored, in that claim 41 describes them more completely as also being formatted and having an assigned unique identification code, which the language of claim 45 omits. It is clear

nevertheless from the description in the preamble of claim 45 that its step modifies the storing step of claim 41, so it therefore must apply to the same type of data as that storing step of claim 41. There is no possibility that claim 45 is referring to the first storing step of claim 41, moreover, since that step involves storing in the Source Material Library, where there are no compressed, sequenced data blocks.

177. Given this analysis in light of the specification, one of ordinary skill in the art of the '992 patent, in January 1991, would have understood the phrase in question and would have understood it to mean that, in addition to the files created and stored by a Transmission System, that Transmission System could separately store other files, perhaps created elsewhere, each including compressed, sequenced data blocks, and each presumably including the unique identification code assigned to the item.

**J. Additional Question 10**

*When reading the step of claim 46 of the '992 patent that says, "retrieving stored formatted data blocks corresponding to requests from users," in light of the specification, would one of ordinary skill in the art in January 1991 have understood this phrase, and, if so, what would he or she have understood this phrase to mean?*

178. Claim 46 depends from dependent claim 45, which, in turn, depends from independent claim 41. All are method claims; claims 41 and 45 and their relationship are discussed in Additional Question 9 above. Because claim 46 is dependent from claim 45, retrieval of formatted data blocks from storage, as described in the clause cited in the question, would occur in a storage environment in which each item of information is stored in its own file, has its own unique identification code, and can have a unique file address, as described in the specification of the '992 patent. (6:48-52).

179. The specification makes provisions for users to request entire items or portions of items. It describes the level of granularity of selection of portions of the data depending on user and system addressing requirements. Through the system operator indexing sections of items, such as, perhaps, individual songs within an album or individual pages in a book, users are enabled to make requests for just those portions of items that they wish to retrieve. Such retrieval can be from the

Compressed Data Library of the Transmission System, with only the requested section being sent to the user's Reception System, or it can be from among the items already buffered in the Reception System to which the user's Receiving Device is connected. (8:32-50).

180. The step in claim 46 prior to the step cited in the question provides that transmission requests to transmit available items were to be received. Those requests would be received from users based upon the lists of items available on the system having been provided to them. Several means for doing so are described in the specification, and the first step of claim 46 provides for generating such a listing of available items. As noted above, that listing could include complete items or portions of items, depending upon the granularity of information capture into the item database by the system operator. Thus, the sequence of events described by claim 46 is first the generation of a listing of available items, including portions of items when such information has been input by system operators, then the receiving of requests for the transmission of available items, and finally retrieving from storage the information requested by users, in the form of formatted data blocks.

181. Given this analysis in light of the specification, one of ordinary skill in the art of the '992 patent, in January 1991, would have understood the phrase in question and would have understood it to mean that stored formatted data blocks containing the particular content requested by users were to be retrieved from the files containing the requested items or parts thereof.

**K. Additional Question 11**

*What would one of ordinary skill in the art have understood the sentence at 7:50-55 of the specification of the '992 patent to have meant in January 1991?*

182. The cited "sentence" suffers from not containing a verb, thereby making it somewhat difficult to understand. Nevertheless, taken in the context of the surrounding sentences, the intent of the inventors can be determined.

183. The subject of the paragraph in which the sentence is contained is inter-library transfers. It is noted that incoming materials in previously compressed form can be sent directly from the Identification Encoder to the Compressed Data Formatter. Then comes the sentence in question, which describes what to do with item database records, such as program notes, that may

accompany the materials sent from another system in the inter-library transfer. It explains that, just as the compressed data is, so too may the item database records be input to the Compressed Data Formatting Section. Once there, if necessary, the item database records can be reformatted for compatibility with other, similar information stored in the Compressed Data Library. (cf. 11:40-44 and 12:58-61)

**L. Additional Question 12**

*What would one of ordinary skill in the art have understood the sentence at 17:15-17 of the specification of the '992 patent to have meant in January 1991?*

184. The cited sentence suffers from a mismatch between a referenced component, the Transmission Formatter, and its reference number, which should be 119 but is given as 122. 122 refers to the various transceivers and transmitters that are on the output of the Transmission Formatter and are described as being communications adapter boards or processors that connect the data processed in the Transmission Format Converter to the respective transmission channels. (15:67-16:3) The sentence describes the addition of redundant data to the data to be transmitted over one-way communications links to allow error correction of the data to be performed in the Reception System.

185. As discussed previously, both the Transmission Formatter and the Transmitter would be capable of adding the sort of redundant data that would permit error correction of the data in the Reception System. Certain types of redundant data (e.g., Reed-Solomon block codes) could be added in either device. Other types of redundant data (e.g., bit-oriented convolutional or trellis codes) likely only could be added in the Transmitter. Regardless of the exact form of redundancy coding to be used, the sentence in question would have been understood by one of ordinary skill in the art of the '992 patent to mean that redundancy coding of the data was to take place between the

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forming of the data into units appropriate for the transmission channel and the emission of that data into the channel by the Transmitter.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Executed this 15th day of December, 2008, at Melbourne, Florida.

S. Merrill Weiss

S. Merrill Weiss